# San Pedro Bay Ports Clean Air Action Plan

April 3, 2008

Dr. Jean Ospital
Health Effects Officer
South Coast Air Quality Management District
21865 Copley Dr,
Diamond Bar, CA 91765

**Re: Comments on MATES III Report**

Dear Dr. Ospital:

The Ports of Long Beach and Los Angeles (Ports) appreciate the opportunity to comment on the Draft MATES III Report and want to thank you for responding to information requests from us and our consultant, ENVIRON International. The Ports also appreciate the meeting you arranged with South Coast Air Quality Management District (SCAQMD) staff to discuss the chemical mass balance analysis (CMB) and regional modeling. We understand that it is time-consuming to produce the supporting information that our consultants have requested and to respond to their questions, and appreciate your efforts to date. We look forward to receiving the balance of the requested information at your earliest convenience.

The Ports believe the effort you are currently undertaking to expand the modeling evaluation presented in Appendix IX, which will allow a more direct comparison of the MATES II to MATES III report results, will be a valuable addition to the MATES III report. This analysis will be useful in addressing questions posed by your Board members at the January 2008 Governing Board meeting and by Technical Advisory Group (TAG) members during their March 13, 2008 meeting. We understand that the revised Appendix IX will be released after the current comment period ends. We look forward to receiving the expanded Appendix and providing you with any comments and suggestions we may have on that important addition to the report.

As you can see in the preliminary set of comments that follow, the Ports have provided feedback that is substantive that is intended to improve the already impressive and substantial efforts of the SCAQMD staff. We believe that our comments, in addition to those from TAG members, will further strengthen the complex analysis represented by the report.

Although we do not have all of the information necessary to provide comprehensive comments, we have prepared detailed comments on key aspects of the Draft MATES III Report. Our comments also respond to information that the SCAQMD staff provided at the March 13 TAG meeting and subsequent March 14 meeting with our consultants. The following section summarizes our major policy and technical comments on the Draft MATES III Report, based on the information we currently have. Detailed technical comments can be found in Attachments A through E. We have also provided copies of past correspondence: Attachment F is ENVIRON's February 25 request for technical data; Attachment G is our March 3 request for an extension of the commenting period to allow for review of the current revision of Appendix IX, which was released on January 28 and the requested technical data.

**Current Comments on the Draft MATES III Report**

MATES III is a comprehensive, research-caliber air toxics study, but the data interpretation and analysis in the draft report are generally limited. This limits the ability for stakeholders, such as the Ports, to comment fully on the Report. Given its scope, the study has generated a wealth of scientific data that will be useful not only to the SCAQMD, but likely to the larger air pollution/health research community for many years to come. In that light, and as discussed throughout the rest of this review, the scientific and technical analyses aimed at interpreting the monitoring and modeling results is relatively incomplete, particularly with respect to (i) addressing the uncertainties associated with estimating cancer risk, (ii) use of various diesel particulate matter (DPM) surrogate(s), and (iii) monitoring / modeling comparisons. Because MATES III is fundamentally a risk assessment, it should be performed and findings communicated in accordance with the basic procedures and principles followed by all regulatory agencies as laid out by the National Academy of Sciences (NAS) in their report, "Risk Assessment in the Federal Government: Managing the Process", including presentation of each of the fours steps of risk assessment (i.e., hazard identification, toxicity assessment, exposure assessment, and risk characterization). Key principles discussed in the NAS risk assessment report also include the need to clearly identify all assumptions and data used in a risk assessment, as well as the need to discuss the key uncertainties. A final key principle of regulatory risk assessment articulated by the NAS is the need to separate risk assessment from risk management. Our comments have been developed in alignment with these procedures and principles because they provide an objective "standard" by which we can evaluate the MATES III risk assessment and because they can provide a structure for our discussion with the SCAQMD. Having such a structure will not only focus our comments, but it will also give us a context for developing our comments in an objective manner and with a constructive purpose.

The following policy and technical issues are of high importance to the Ports, and we believe may be significant to other stakeholders and the public. We ask that they be considered by the SCAQMD and addressed in the final MATES III Report.

1. **Risk Assessment vs. Risk Management**
   The Executive Summary includes a statement in the Conclusion section that, "[w]hile there has been improvement in air quality regarding air toxics, the risks are still unacceptable and are higher near ports and transportation corridors." First, from a policy perspective, the Ports believe that the conclusion that the risks are "unacceptable" is a risk management determination and should be presented in a separate planning document or, at least, in a separate and clearly identified risk management section of the MATES III report. The Ports recognize that the contribution to local and regional risks from goods movement operations is real, measurable, and must be reduced. However, for purposes of a scientific report, such as MATES III, we would recommend a broader and more objective context for the discussion of risk and what are acceptable and achievable goals for reduction of risk. This will benefit the decision makers to whom the report is addressed, and the public whose sense of well being is likely to be influenced by the report. For example, we think it is important to note that there is no current regulatory limit on cumulative risk from carcinogens in the air; rather cancer risks are regulated by imposing specified risk limits for individual sources (such as refineries or power plants). This is why the Ports made the landmark commitment under the San Pedro Bay Ports Clean Air Action Plan to establish standards for the reduction of risk over time. Setting such standards is challenging for a complex goods movement facility with multiple operators and mobile sources, and there is no regulatory or scientific guidance on what an "acceptable" or health protective standard should be. It is further

suggested that, to help decision makers and the public put the risks posed by air toxics in the South Coast Air Basin in perspective, the report should compare the estimated risks to those estimated for other air basins in California and to those estimated for other major metropolitan areas outside of the state. In addition, the estimated risks should be compared to other everyday sources of cancer risk and to the background cancer risk in California.

Second, and more important to a clear and consistent assessment of risk, as discussed in the sections that follow, the draft Report does not appear to adequately describe how the SCAQMD came to its conclusions regarding "higher risk" levels near ports and transportation corridors. The monitoring data indicate that measured risk levels are relatively similar throughout most of the Basin. This issue was acknowledged by SCAQMD staff at the March 13 MATES III TAG Meeting. Moreover, there is not an understandable correlation between the monitored or measured data and the modeling data used to assess risk at various locations within the South Coast Air Basin (Basin). The Ports look forward to working with SCAQMD technical staff to better understand and resolve these apparent discrepancies. We believe that this resolution is important to the future development of sound risk management programs and public expectations of the results of such programs.

2. **Insufficient Expert Scientific Review**
The SCAQMD initially took steps to ensure that the MATES III effort was overseen by recognized experts in related scientific disciplines. The MATES TAG provided input to the SCAQMD during the planning and data collection phase of MATES III; however, that process appears to have been terminated in September 2004, long before the MATES III monitoring data analysis, DPM surrogate revisions (including the CMB analysis used to estimate DPM in MATES III), or regional modeling was conducted. Releasing the draft Report before its data, methodology and results were reviewed by the TAG is not consistent with the SCAQMD's process used during the development of the 2007 Air Quality Management Plan (AQMP), which incorporated input from the Scientific, Technical, and Modeling Peer Review (STMPR) Advisory Group. It is our belief that the timing of the March 13, 2008 TAG meeting did not provide sufficient time for outstanding technical issues to be discussed fully before the April 4 close of the comment period. At the TAG meeting, several significant technical issues were raised that should be addressed in the final report, as well as in response to comments. For example, the impact of higher PM emissions from spark-ignited engines during certain seasons could affect the conclusions of the Report.

3. **MATES III and MATES II Comparison**
MATES II results are presented in the report and some general comparisons are made with MATES III using broad indicators such as basin-averaged or time-averaged emissions, DPM levels, and risk. Results between the two studies are not directly comparable since different methods were used, however a more detailed comparison between the two studies is certainly possible to a greater degree than presented in the current report. This has been acknowledged by the SCAQMD at the TAG meeting and we appreciate that your staff are conducting additional modeling studies that will be incorporated into a revised Appendix IX. Further interpretation of the trends between the two studies is warranted since the trends over time in toxics levels and associated risks within the South Coast Air Basin are arguably the most important outcome of the MATES efforts. These trends are valuable indicators of the effectiveness of air pollution controls in the South Coast. We have requested the MATES III modeling data to assist

our understanding of the cited risk reductions, examine areas of interest to the Ports and their surrounding communities, and to understand the extent to which such trends are supported by both monitoring and modeling data.

4. **Modeled and Monitored Risk Comparison**
Although the MATES III report provides a broad comparison of monitored and modeled concentrations of DPM and risk, it stops short of resolving or offering explanations for differences observed from location to location. Specifically, among the MATES III monitoring stations, the North Long Beach station shows one of the two lowest monitored risk values and the Fontana station was the highest among Basin monitoring stations. However, when comparing the monitoring results to the modeling results (c.f., Figure ES-4), the modeling results show a higher level of predicted risk in the central coastal areas (including the San Pedro Bay port area) and a lower level of predicted risk in both San Fernando Valley and the Inland Empire. Thus, it appears as if the modeling results are higher than the monitored results in the western Basin and are lower than the monitoring results in the eastern Basin. This issue was acknowledged by SCAQMD staff at the March 13 MATES III TAG meeting. (See Attachments B, C and D of this letter for additional technical comments on this issue). Since the modeling results appear to provide the basis for the conclusions regarding the greatest sources/areas of risk in the region, the Ports believe that broad conclusions regarding the relative importance and extent of specific sources of risk are not warranted until these significant technical issues are resolved.

   More generally, the statement at the bottom of page 4-10 that the model has 'acceptable accuracy' based on the broad performance of a subset of compounds needs to include reference(s). Evaluating the modeled risk results against the risks estimated using a combination of monitored concentrations and CMB apportionment is especially important, since there may be significant uncertainty introduced in the CMB analysis step (see Attachment B). Lastly, our consultants are still waiting to receive important model data necessary to fully comment on the MATES III analyses. SCAQMD staff has been very responsive to their requests, but as of March 28 there is still information we have not yet received. We are informed by our consultants that it will require additional time to use this information in the analyses needed to complete our comments on the critical component of the Report. This was the basis for our previous request for an extension of the commenting period.

5. **CMB-based DPM Estimates May Be Overestimated**
MATES III relies on a chemical mass balance (CMB) model to estimate the contribution of DPM to elemental carbon (EC) measured as $PM_{2.5}$. Although this approach appears to be a substantial improvement to the methods used in MATES II, it raises new questions about the accuracy of estimated DPM concentrations. Further investigation is warranted given the overwhelming predicted influence of DPM levels on estimated risk. This investigation should focus on the (i) choice of a diesel source-profile (one major source of uncertainty is the use of only a single source profile for diesel particulate matter), the cause of the over-estimation of $PM_{2.5}$ mass in CMB, and (iii) the potential use of positive matrix factorization for evaluation. In addition, several TAG members raised additional comments on the CMB modeling that should be addressed in updated analyses.

   As you are aware, the Ports have been conducting air monitoring in the port area. We have requested the MATES III monitoring and modeling data, in part, so that we can better understand the results and implications of the MATES III study on the Ports and their neighboring communities. Attachment C also discusses the very preliminary analysis that we have been able to conduct using these data. It suggests that the relationship between emissions from Port sources, local monitored concentrations of particulates, and MATES III monitored / modeled risks are far more complex than that suggested in the MATES III Executive Summary. This relationship is particularly important to understand clearly as the SCAQMD begins development of the latest revision to its Air Toxics Control Plan. We look forward to discussing this specific issue with your staff during the development of that Plan.

We hope that these comments, as well as additional comments based on our review of those data yet to be received, will be incorporated into a revised final report.

**Conclusion and Continued Work with District Staff**

Both the peer and public review processes are critical elements of technical evaluations such as MATES III that support regulatory and public policy decisions. Clearly the MATES evaluations have played a significant role in air quality management decisions in the South Coast Air Basin, including previous Air Toxics Control Plans. The Ports appreciate the opportunity to participate in the process and to provide constructive comments. While we appreciate your efforts to date to provide that information we need to fully comment, we do not have all of the supporting technical information we have requested. We must be allowed a reasonable amount of time in which to complete this review, including analysis of the data we are just receiving. In response to our request for an extension of the MATES III commenting period (see Attachment G), SCAQMD Executive Officer Dr. Barry Wallerstein has stated that your staff will continue to work with the Ports' staff and their consultants on the outstanding technical issues. These include the issues raised in this letter, previously discussed with SCAQMD staff at the March 13 TAG meeting and other communications, as well as those identified during the review of data / information currently being delivered. While those discussions continue, we would ask that our current comments, as well as comments by TAG members and other stakeholders, be reflected in the Final MATES III Report.

Thank you again for the opportunity to comment on this important study and Dr. Wallerstein's commitment to continue working with Port staff on outstanding technical issues. Please feel free to contact either Ralph Appy, Port of Los Angeles, at (310) 732-3497 or Richard Cameron, Port of Long Beach, at (562) 590-4156 if you have questions or concerns regarding this request.

Sincerely,

RALPH G. APPY, Ph.D.
Director of Environmental Management
Port of Los Angeles

RICHARD CAMERON
Director of Environmental Planning
Port of Long Beach

cc: Dr. Barry Wallerstein, Executive Officer
Dr. Rob Scofield and Mr. Ralph Morris, ENVIRON International Corporation

ADP No. 040826-597

Attachments:

- Attachment A: Initial Review of the MATES III Health Risk Approach
- Attachment B: Initial Review of the MATES III Diesel PM Methodology
- Attachment C: Initial Review of the MATES III Monitoring Effort
- Attachment D: Initial Review of the MATES III Regional Modeling Effort
- Attachment E: Initial Review of the MATES III Emissions Inventory
- Attachment F: February 25, 2008 Request for MATES III Data and Related Information
- Attachment G: March 3, 2008[JCL1] Request for a 30-Day Extension of the MATES III Comment Period

# Attachment A: Initial Review of the Health Risk Component of MATES III

The risk assessment performed by the South Coast Air Quality Management District (SCAQMD) and published as the Multiple Air Toxics Exposure Study III (MATES III) is a follow on evaluation to two previous assessments of the cumulative health risks posed by toxic air contaminants in the South Coast Air Basin (Basin). While the Study originated as part of the SCAQMD Governing Board Environmental Justice Initiative, the objectives of the MATES studies extend beyond characterizing differences in levels of exposure and health risk between communities in the Basin. Various additional objectives are noted in the body and Appendices of the draft MATES III report (SCAQMD 2008). Like the predecessor studies, MATES I and MATES II, MATES III provides an estimate of the cumulative cancer risk posed by toxic air contaminants in the Basin and presents a characterization of the level of risk associated with specific chemicals and the sources of emissions of these chemicals.

The periodic updates of the MATES evaluations allow for tracking changes in exposure and risk over time. Not only do the updates allow for tracking of changes in total risk but they allow for tracking changes in the relative importance of specific substances and sources. The risk assessments performed under the MATES program have become an extremely important and influential evaluation behind regulatory priority setting in the Basin.

Because MATES III is a risk assessment, we believe that it should be performed in accordance with the basic procedures and principles laid out by the National Academy of Sciences (NAS) in their 1983 report, “Risk Assessment in the Federal Government: Managing the Process”. Because these are unassailable principles by which any public or private organization is obligated to abide, they provide an objective framework by which we can structure our evaluation of MATES III. According to the procedures and principles laid out by the NAS, any risk assessment must: 1) identify the health effects associated with each chemical; 2) characterize the dose-response relationship for each chemical; 3) characterize the exposure to each chemical; and 4) characterize the health risk. The fourth step, risk characterization, includes a quantitative estimate of risk as well as a discussion of uncertainty. All data and assumptions used in the risk assessment are to be clearly identified. Finally, one of the most important principles espoused by the NAS is the need to separate the objective risk assessment process from the normative risk management process.

## Executive Summary and Chapter 1. Introduction

MATES III developed out of the SCAQMDs 1997 Environmental Justice Initiative as a follow-up to MATES II; both efforts were conceived to determine the effectiveness of toxic air contaminant (TAC) reduction programs on communities with lower incomes or multiple sources of TACs. As the MATES II report before it, the MATES III study focuses on Basin-wide cancer risks from exposure to toxic air contaminants (TACs). MATES III does not estimate mortality or other health effects from exposure to particulate matter, noting that this analysis was included in the 2007 SCAQMD Air Quality Management Plan.

The MATES III study utilized different methods than MATES II to estimate concentrations of diesel exhaust particulate matter (DPM). Although this prevents direct comparisons between the two sets of results, the key findings of the two studies are contrasted below:

- The MATES III study reported a decrease in the Basin-wide lifetime average risk of cancer relative to MATES II. Based on an average concentration of TACS at fixed monitoring sites, cancer risk was estimated in the MATES III report to be approximately 1200 in a million. The corresponding estimate from MATES II was 1400 in a million.
- DPM was identified in MATES III as the major contributor to risk from TACs, accounting for approximately 84% of the total Basin-wide risk. The MATES II report attributed 70% of Basin-wide cancer risk to DPM.
- Levels of elemental carbon in the $PM_{10}$ fraction were estimated to be 28% lower than those determined in MATES II.
- MATES III identified the highest risk in the Basin as occurring in the area surrounding the San Pedro Bay ports, with the highest modeled grid cell indicating a risk of 2900 in a million. While MATES II did not single out the ports for comment, both DPM-attributable risk and total risk were highest for the Wilmington monitoring site.

Because the MATES III report concludes that DPM is the dominant contributor to risk attributable to chemicals in the ambient air in the Basin – as well in specific locales, and that DPM emissions have decreased only modestly since the MATES II risk assessment was completed, a primary focus of our evaluation will be the issue of whether there is sufficient information provided in the MATES III report (and whether any supplemental information is available from the SCAQMD) that provides adequate support for the conclusions. More specifically and directly related to these issues, is the question of whether the DPM-related cancer risk estimates are consistent with the monitoring and modeling data.

Pivotal to all of these issues is the validity and accuracy of the method used to estimate DPM concentrations from particulate matter (PM), and thus how DPM-attributable cancer risk was determined. MATES III relies on a chemical mass balance (CMB) model to estimate the contribution of DPM to elemental carbon (EC) measured as $PM_{2.5}$. This estimation method relies on the inclusion of all significant EC sources, existence of accurate and representative source profiles, the identification of unique indicator compounds, and the concurrent measurement of numerous particle-bound compounds to discriminate between PM sources. Although this approach appears to be a substantial improvement to the methods used in MATES II, it raises new questions about the accuracy of estimated DPM concentrations. Attachment B describes these questions in detail, but for example:

1. A single study served as the basis for the DPM source profile. Although this study obtained data from 34 different vehicle types, it is still a single data point. Sensitivity analyses should have been conducted with other DPM profiles (and potentially, other DPM indicator compounds) to evaluate a range of outcomes. DPM-attributable cancer risks for the range of outcomes should have been provided.
2. To the extent possible, model validation (or at least, reality checks) should have been conducted to compare modeled DPM concentrations to monitored levels of $PM_{2.5}$.

One of the key questions of MATES III is whether, and to what extent, DPM concentrations (and cancer risk) have declined relative to MATES II. The reliance of SCAQMD on different DPM estimation methods between the two reports means that direct comparison of results is not readily achievable. However, MATES III notes that relative to MATES II, EC measured in $PM_{10}$ showed a decrease of approximately 38%; 10% of this decrease was attributed to differences in instrumentation, leaving a net reduction in $PM_{10}$ of ~28%. Additionally, the Executive Summary notes that if MATES II methods were used with MATES III data, there is approximately a 40% reduction in risk between the two studies. Recognizing that there are uncertainties in both of these estimates, it is still surprising that SCAQMD minimizes – almost discounts - the apparent successes of emissions reductions programs as evidenced by these two values. It is important to further characterize and understand these apparent reductions in risk, and examine if they are 1) localized or Basin-wide and 2) supported by both monitoring and modeling data.

On a more general note, the Executive Summary as well as other relevant sections of the report should specify how risk was calculated i.e., what human receptor population(s) were addressed, what exposure route(s) were evaluated, and what exposure parameters were used to estimate dose. This very basic information is not mentioned anywhere in the report. Throughout the report, there is not sufficient detail provided for readers to readily follow methods or replicate results.

The Executive Summary includes a statement in the Conclusion section that, "[w]hile there has been improvement in air quality regarding air toxics, the risks are still unacceptable and are higher near ports and transportation corridors." The conclusion that the risks are "unacceptable" is a risk management determination and should be presented in a separate planning document or, at least, in a separate and clearly identified risk management section of the MATES III report. The Ports recognize that the contribution to local and regional risks from goods movement operations is real, measurable, and must be reduced. However, for purposes of a scientific report, such as MATES III, we would recommend a broader and more objective context for the discussion of risk and what are acceptable and achievable goals for reduction of risk. This will benefit the decision makers to whom the report is addressed, and the public whose sense of well being is likely to be influenced by the report. For example, we think it is important to note that there is no current regulatory limit on cumulative risk from carcinogens in the air; rather cancer risks are regulated by imposing specified risk limits for individual sources (such as refineries or power plants). This is why the Ports made the landmark commitment under the San Pedro Bay Ports Clean Air Action Plan to establish standards for the reduction of risk over time. Setting such standards is challenging for a complex goods movement facility with multiple operators and mobile sources, and there is no regulatory or scientific guidance on what an "acceptable" or health protective standard should be. It is further suggested that, to help decision makers and the public put the risks posed by air toxics in the South Coast Air Basin in perspective, the report should compare the estimated risks to those estimated for other air basins in California and to those estimated for other major metropolitan areas outside of the state. In addition, the estimated risks should be compared to other everyday sources of cancer risk and to the background cancer risk in California.

## Chapter 6. Results

This Chapter includes a note (3rd bullet, Section 6.4) that there are uncertainties in "....the cancer potencies of the substances, and in estimating the level of diesel particulate." Despite the fact that diesel particulate accounts for 84% of the estimated risk, there is no discussion of the specific nature of the uncertainties associated with the diesel particulates. Neither is there any acknowledgment that that the USEPA and other States calculate the cancer potency for DPM differently or what such a treatment would have on the estimated level of risk in the basin and on the relative risk attributed to diesel exhaust.

There is no discussion of the lack of correlation of diesel risk with PAH levels, the chemicals generally thought to be the primary contributors to the carcinogenic risks associated with diesel exhaust.

Following the NAS guidelines, it would be important to add a discussion describing the conservative nature of regulatory risk assessment using language similar to that provided by OEHHA and CARB in the Hot Spots guidance and similar to that provided by the USEPA in the cancer guidelines.

This Section also needs to include additional detail on the distribution of cancer risk. For example, a variation of the figure provided as figure ES-9 should be provided here, but with a much greater level of resolution. The detail required should be sufficient to allow the reader to readily discern the geographic area impacted by each risk category i.e., the 'over 1200' in a million grouping.

### Appendix I. List of Substances and their Associated Risk Factors

This Appendix consists of a table of monitored substances and their associated toxicity criteria. The Appendix does not identify or attribute the source(s) of the criteria listed here. The Appendix also contains a number of errors or oversights, including:

- No toxicity criteria are provided for DPM.
- Chloromethane and beryllium are listed in Table 2-1 (Substances Monitored in MATES III), but are not listed in this Appendix.
- Selenium, Methyl ethyl ketone, dibromomethane-1,2, and MTBE are listed in the Appendix, but not in Table 2-1.
- There are a number of inconsistencies in nomenclature between the two tables for a number of other chemicals.

### Appendix IV. Measurements of Naphthalene and Other Polycyclic Aromatic Hydrocarbons

There appears to be a lack of correlation between the monitored levels of naphthalene and PAHs and estimated DPM risks that warrant evaluation and discussions. We plan to look closely at this issue.

### Appendix V. $PM_{2.5}$ Particulate Bound Organic Compound Analysis

This Appendix provides the rationale for the chemical analysis of $PM_{2.5}$ particulate bound organic compound analyses, as well as details of sample collection, sample handling, and sample analysis. To adequately review this information, and to understand how it impacts estimates of DPM concentrations, the resulting analytical data should be included here.

### Additional Data Requests

- A figure, similar to Figure ES-9, but with a much greater level of resolution is needed. The detail required should be sufficient to allow the reader to readily discern the geographic area impacted by each risk category.

- To support a better understanding of the data used to determine DPM concentrations, complete analytical results from the $PM_{2.5}$ Particulate Bound Organic Compound Analysis are needed.
- The source profile used to estimate DPM should be provided.

## References for Attachment A

National Research Council (NRC). 1983. Risk Assessment in the Federal Government: Managing the Process. Committee on the Institutional Means for Assessment of Risks to Public Health. Commission on Life Sciences. National Research Council. National Academy Press, Washington D.C.

# Attachment B: Initial Review of the Chemical Mass Balance (CMB) Methodology to Estimate the Contribution of DPM

## General Comments on using CMB Models

As part of the MATES III study, the South Coast Air Quality Management District (SCAQMD) revised the method for estimating exposure to diesel particulate matter (DPM) based on ambient measurements. In the MATES II study, measured ambient elemental-carbon (EC) data were used as a surrogate for DPM, multiplying EC levels by factors accounting for: 1) the fraction of ambient EC levels from diesel sources compared to other sources (since EC is not a unique tracer for DPM); and 2) the ratio of total particulate mass to EC mass in the emissions from diesel sources (to convert from EC to particulate matter mass).

In the MATES III study, a different approach was chosen, using the Chemical Mass Balance (CMB) model to estimate DPM mass. CMB makes use of detailed source "fingerprints" (source-composition data) to apportion measured speciated ambient $PM_{2.5}$ data to its contributing sources. As such, it may be able to provide a more accurate estimate of DPM levels, compared to the use of EC as a surrogate.

However, source-apportionment results from CMB still contain a fair amount of uncertainty, arising from:

1. the choice of source-profiles to be used in the analysis,
2. collinearity in source-profile compositions,
3. the model-assumption of fixed source-compositions, and
4. at times, uncertainty associated with not accounting for all major sources affecting the air-shed.

The choice of source-profiles to be used in the analysis is a critical step. For many source-categories, the apportionment process is driven mainly by a single tracer. Hence, the fraction of that tracer out of total $PM_{2.5}$ emissions at the source may have a great influence on the amount of mass apportioned to that source-category. This, in turn, may affect the amount of mass apportioned to other source-categories as well. Collinearity in source-profile compositions ("similarities" between profiles, or more mathematically the case where source-profiles are not linearly independent of each other) might lead to uncertainties/instability in how CMB apportions mass between the two collinear sources. This is often the major limitation of CMB in differentiating between emissions from various source-categories. This is especially true for differentiating the relative contributions from gasoline and diesel vehicles, as their emissions are both carbon-rich, and they often share similar tracers. The use of organic markers assists in reducing some of the uncertainty associated with this split, but much uncertainty still remains. The use of time-unvarying source profiles introduces another level of uncertainty, and may be especially true for mobile-sources, where driving patterns can have a substantial effect on source-compositions. It is common practice to average source-compositions over a wide range of driving conditions, but the implementation of a single "average" profile in a CMB analysis is bound to introduce uncertainty. Finally, failing to include some relevant source categories in a CMB analysis might affect how mass is apportioned to the other source categories, as CMB will attempt to reconstruct ambient tracer levels using the sources that were included in the analysis, and might lead to substantial errors.

## Specific comments to the application of CMB in MATES III

Reviewing the application of CMB in the MATES III study, it seems that much effort has been placed in performing the analysis, and this provides a good basis for estimating DPM levels. However, several caveats were identified and are summarized below:

1. **Overestimation of $PM_{2.5}$ levels / inclusion of all contributing sources:**
   a. It is clear that much attention has been given to the choice of source-profiles to be used in the analysis. In addition, several sensitivity analyses have been performed, to quantify some of the uncertainties arising from such a choice. However, while several profiles for gasoline-vehicle and biomass-burning were used, only one profile from a single study was used for diesel vehicles. Despite this profile being fairly recent and locally measured/developed, questions on its representativeness arise, especially when considering how very substantial differences in apportioned mass were identified when two different profiles were used for gasoline vehicles, (the "NFRAQS" and "SoCAB" profiles). Despite the "SoCAB" profile being "representative" of the study region, surprisingly (and likely unrealistic) low levels of $PM_{2.5}$ were apportioned to the gasoline-vehicles category based on the "SoCAB" profile, and the emphasis in Appendix VII was therefore placed on the results based on the "NFRAQS" profile. Once again, the question of uncertainties associated with the use of a single profile (in this case, for diesel vehicles) arises, as well as how these results might change if other source profiles were evaluated further.
   b. $EC/PM_{2.5}$ ratio: since EC concentrations were the driving factor in apportionment of $PM_{2.5}$ mass to the diesel category (MPIN absolute value of 1.0; page 5), a key factor affecting the amount of that mass is the $EC/PM_{2.5}$ ratio in the source profile. This, since CMB will attempt to reconstruct EC levels using the diesel profile, and the amount of total $PM_{2.5}$ mass associated with this category would highly depend on the $EC/PM_{2.5}$ ratios. The $EC/PM_{2.5}$ ratio in the diesel profile used (Chow et al., 2007) is 0.51, which is relatively low, and would result in approximately 2 $\mu g/m^3$ DPM $PM_{2.5}$ contribution for every 1 $\mu$g/m3 diesel EC. For comparison, typical $EC/PM_{2.5}$ ratios in diesel profiles from the NFRAQS study (Zielinska et al. 1998), not used in MATES III, are 0.599-0.623 for light-duty diesel vehicles, and 0.735-0.771 for heavy-duty diesel vehicles. This would result in approximately 1.6, 1.3, and 1.5 $\mu g/m^3$ DPM $PM_{2.5}$ contribution for every 1 $\mu g/m^3$diesel EC, for light-duty, heavy duty, and equal blend of the two, respectively. These numbers are 17-33% lower than the current DPM contribution estimates from MATES III, based on the "SoCAB" profile.
2. **Overestimation of $PM_{2.5}$ levels / inclusion of all contributing sources:** A crucial step in CMB analyses is the inclusion of all sources expected to contribute to ambient $PM_{2.5}$ levels. If some sources are excluded, this might lead to substantial errors in the apportionment of mass to the remaining source categories (Christensen, 2004). While it seems that all major sources of primary $PM_{2.5}$ were included in the analysis, secondary organic aerosol (SOA) is not accounted for in this study. SOA cannot be estimated directly

in CMB, but rather by not including OC as a fitting species, the fraction of OC not apportioned to sources of primary OC (total OC – apportioned OC) can serve as an estimate, or an upper bound, to SOA levels. In this application, OC data were not used due to data quality issues. Hence, SOA could not be estimated by difference. However, total reconstructed $PM_{2.5}$ levels are consistently higher than measured levels at all ten sites. This means that the ten sources that were included in the analysis already overestimated the levels of measured ambient $PM_{2.5}$. Given that SOA was not included in the analysis, this is especially surprising, as SOA would, in practice, account for a certain portion of ambient $OC/PM_{2.5}$. This means that some of the mass associated with the various source categories must be overestimated, and this applies especially to any carbon-rich sources, such as diesel, gasoline, biomass burning, meat cooking, and oil burning. The overestimation of $PM_{2.5}$ mass could also be, in part, due to the relatively low $EC/PM_{2.5}$ ratio in the diesel profile (see 1-b above).

3. **Comparison with other source-apportionment methods:** a useful way of evaluating the findings from the CMB analysis is to compare them to results based on other modeling efforts. The Positive Matrix Factorization (PMF) model is a commonly applied one. It derives "source" (factor) composition estimates by analyzing trends in the ambient data, rather than relying on measured source-profiles. However, the identified profiles are not always easy to interpret, and a large dataset is needed in order to perform the analysis. The Executive Summary (page ES-6) mentions that PMF was not used as "some sources could not be interpreted and some profiles could not be confirmed with confidence". Further investigation into the use of PMF may turn out valuable, as an additional way of evaluating the findings from the CMB analysis and estimating uncertainties associated with the source-apportionment process. The dataset collected for MATES III should be sufficient for running PMF, and can be further enhanced by conducting a "region-wide" analysis, combining the measurements at the various sites into one (powerful) dataset to be analyzed using PMF. This should be a valid approach given a fairly uniform air-shed.
4. **Limestone contributions:** The Rubidoux site was the only one in which a limestone profile was included, to assist in the reconstruction of ambient calcium levels at the site. At all other sites, the limestone contribution was effectively zero. However, when presenting the 10-site average contributions, the Rubidoux contribution was applied, suggesting it is representative of the entire air-basin. This should be corrected, and the average recalculated to reflect an effective non-contribution at nine out of the ten sites investigated.

Based on our initial review, it appears that the CMB-based DPM estimates in MATES III may be overestimated. Further investigation is warranted given the overwhelming predicted influence of DPM levels on estimated risk. This investigation should focus on the choice of a diesel source-profile, SOA levels, the cause of the over-estimation of $PM_{2.5}$ mass in CMB, and the potential use of PMF.

## Status of data requests

On February 25, 2008, ENVIRON requested data files and information related to the CMB modeling. Below is a summary of the data received and those data that are still pending:

1. Dataset of all ambient data collected – *ENVIRON has received both the data used in CMB modeling and the raw ambient data files.*
2. Detection limits for the various species – *ENVIRON is still working with District staff to understand the District staff's approach for detection limits in its analysis (e.g., data were used as measured, regardless of detection limit)..*
3. Short explanation of how missing values and, if applicable, values below detection limit were treated in preparing CMB inputs – *see Section 2 above.*
4. All CMB input files (for all sites): Most data were received on March 14$^{th}$.
   a. Ambient data set(s), including uncertainties in species concentrations. – *ENVIRON has received this information.*
   b. All source-profiles used in the analysis, including uncertainties in source-compositions. – *ENVIRON has received this information.*
   c. List of fitting species used in each one of the site analyses conducted, including sensitivities (species "select" files for the various analyses would be very helpful) – *ENVIRON has received this information.*
   d. Indication as to which source-profiles were used in each one of the site analyses conducted, including sensitivities (profile "select" files for the various analyses would be very helpful) – *ENVIRON has received this information.*
5. Raw CMB output files (post-processed CMB results will be useful as well) – *ENVIRON received a set of voluminous output hardcopies (March 14$^{th}$ for Year 1, March 26$^{th}$ for Year 2), but we believe that the raw output files (in electronic format) would be needed for us to be able to comment. These files will enable us to review the quality of fit for the various apportionment results, better understand the relative importance of the various species in the process, and comment on whether these seem reasonable. Post-processed files (e.g., excel spreadsheets with source apportionment results for the various sites) would be very useful as well, as it will allow analyzing spatial and temporal trends in apportionment results, beyond what it currently present in the report. Specifically, it would allow investigating source inter-correlations and effects of collinearity on the final results, as well as source-species correlations, another indicator of the relative importance of the various species in the apportionment process. We are currently discussing these issues with District staff.*

## Technical Advisory Group (TAG) Comments

At the March 13, 2008 TAG meeting, several TAG members commented on the CMB analysis. Their major comments included:

- Spark-ignited (generally gasoline-powered) vehicles emit EC also and that cold-starts during the fall/winter will increase the amount of their contribution to EC relative to diesel trucks. The same could apply on weekends, when you would generally expect a higher ratio of gasoline vehicles (e.g. cars) to diesel trucks than on weekdays. Although District staff cited some technical reasons that limit their ability to address these comments (e.g., filter contamination), ENVIRON believes that the District staff should consider sensitivity studies based on the comments by TAG members.

- The seasonality issue could dramatically impact the MATES III analysis. If the diesel/gasoline EC ratio is not accurate during the colder fall / winter months when $PM_{2.5}$ and PM EC concentrations are highest, the study could be inappropriately applying the DPM risk factor to non-DPM PM concentrations. This issue warrants serious review by District staff, perhaps in conjunction with TAG members that have raised the issue.
- We understand from the comments made by Joe Cassmassi at the TAG meeting that the District will be doing a weekday/weekend sensitivity analysis for the regional modeling, but it is not clear the extent to which the weekday/weekend issue has been (or will be) addressed in the CMB modeling.

- TAG members raised the issue of how organic carbon (OC) was handled in the CMB analysis. Although District staff responded at the TAG meeting, a more complete response to specific technical questions on this issue would be needed to determine if the District's approach is technically defensible and would not lead to any artifacts that could alter the results of the analysis.
- Several issues were raised with respect to ship emissions, including the substantial differences in the composition of ship diesel emissions compared to diesel truck emissions and how those are (or are not) reflected in the CMB and regional modeling analyses. For example, it appears as if the CMB analysis used the residual oil burning (ROB) profile to characterize ship emissions; in the regional modeling analysis, ship DPM emissions were used. The District may want to consider meeting with a separate sub-group of TAG members and interested stakeholders to thoroughly consider these issues, and make revisions and/or provide clarifying documentation in the final report.

## References for Attachment B

Christensen, W.F. (2004), Chemical mass balance analysis of air quality data when unknown pollution sources are present, Atmospheric Environment 38 (26), 4305-4317.

Zielinska, B.; McDonald, J. D.; Hayes, T.; Chow, J. C.; Fujita, E.M.; Watson, J. G.; (1998). Northern Front Range Air Quality Study Final Report. Volume B: Source Measurements.

# Attachment C: Overview of Toxics Monitoring

MATES III monitored for 33 toxic air compounds at ten fixed monitoring stations as well as five short-term micro-scale locations. The fixed monitoring station locations are shown below in Table C-1 and in Figure C-1. Huntington Park and Pico Rivera only operated for Year 1 of the study (April 2004 – March 2005).

**Table C-1: Location of Fixed Monitoring Stations in MATES III Study**

| Site | Acronym | Address |
|---|---|---|
| Wilmington | WI | 1903 Santa Fe Avenue (Note: in Long Beach) |
| North Long Beach | LB | 3648 North Long Beach Boulevard |
| Compton | CP | 720 North Bullis Road |
| Huntington Park | HP | 6301 South Santa Fe Avenue |
| Los Angeles | LA | 1630 North Main Street |
| Pico Rivera | PR | 3713B San Gabriel River Parkway |
| Burbank | BU | 228 West Palm Avenue |
| Anaheim | AN | 1010 South Harbor Boulevard |
| Fontana | FO | 14360 Arrow Highway |
| Rubidoux | RU | 5888 Mission Boulevard |

NOTE: The stations are roughly grouped by distance from the Ports.

The fixed monitoring stations recorded data every three days over a two year period, sampling for 24-hour average concentrations of toxic air contaminants. The list of contaminants monitored is shown in Table C-2 below.

**Table C-2: Substances Monitored in MATES III**

| | | |
|---|---|---|
| Benzene | 1,3-Butadiene | Carbon Tetrachloride |
| Chloroform | Chloromethane | Dichlorobenzene |
| Methylene Chloride | Perchloroethylene (Tetrachloroethylene) | Dichloroethane |
| Ethylbenzene | Toluene | Trichloroethylene |
| Xylene | Styrene | Vinyl Chloride |
| Acetaldehyde | Formaldehyde | Acetone |
| Arsenic | Beryllium | Cadmium |
| Hexavalent Chromium | Copper | Lead |
| Manganese | Nickel | Zinc |
| Elemental Carbon | Organic Carbon | Naphthalene |
| PAHs | $PM_{10}$ | $PM_{2.5}$ |

In addition, MATES III monitored at five temporary micro-scale locations, which operated for about three-months each (Sun Valley operated for almost a year), as data validation for a nearby fixed station location. In addition to 24-hour sampling every three days, the micro-scale locations also had 8-hour sampling for VOCs on select days. The micro-scale locations were located at:

- Commerce
- Indio
- Santa Ana
- Sun Valley
- San Bernardino

The report did not disclose the addresses or specific locations at which these micro-scale stations were installed.

## Comments on the MATES III monitoring

The focus of this preliminary review of the MATES III monitoring data is on elements of the monitoring program related to diesel particulate matter (DPM), measurements of particulate matter less than 2.5 microns ($PM_{2.5}$) and associated elemental carbon ($EC_{2.5}$), due to the MATES III study's conclusion that 83.6% of the South Coast Air Basin (SCAB)-wide risk was due to DPM. ENVIRON's initial review indicates three areas of concern regarding the evaluation of air monitoring data in the MATES III study:

- There are potentially relevant air monitoring data from stations operated by either the California Air Resources Board (CARB) or by the Ports of Los Angeles (POLA) and Long Beach (POLB) that could be used to further evaluate the MATES III DPM surrogate determination and modeling analysis. The preliminary analysis of these data indicate that potential inconsistencies between the data sets exist. In addition, the data indicate a higher degree of uncertainty in the assessment of source attribution (especially between regional and local DPM sources) to specific monitors that requires further consideration or study before final conclusions can be drawn. These issues include a specific issue raised by the Technical Advisory Group (TAG) related to EC contributions from spark-ignited engines.
- There is a lack of agreement between monitored $PM_{2.5}$ results and results from the Chemical Mass Balance (CMB) approach used in the study.
- There is insufficient evaluation of modeled risk at the monitoring station locations with risk results from monitoring data.

These three areas are discussed in additional detail in the sections below.

It should be noted that while District staff has been very responsive to ENVIRON's request for MATES III supporting data, ENVIRON either still does not have all information we have requested from the District, or has only recently received information that requires additional time to review due to the amount of raw data provided (e.g., modeling information that requires data to be transferred via a hard-drive). Therefore, ENVIRON would require additional time to use this information, , in the analyses described in this attachment. However, ENVIRON's preliminary analysis has indicated that the three areas of concern identified above may be significant enough to require either further study or an expanded discussion of uncertainty in a revised MATES III report to fully address our concerns (see below). At the least, the uncertainty in measured concentrations and the inability to draw more definitive conclusions on source contributions at individual monitors should be discussed in the final MATES III report, as source attribution is an important piece of data used for risk management decisions.

1. **Other Potentially Relevant Air Monitoring Data**
   The MATES III study did not include a comparison to other potentially relevant air monitoring data sets available for $PM_{2.5}$ and EC in the SCAB. The MATES III study looked solely at MATES III fixed stations in order to determine risk throughout the SCAB and disregarded other available data sets. As only a limited amount of data from fixed MATES III stations were used to characterize a large air basin of 16 million people, other data, if available and applicable, would provide the basis for a useful, additional comparison or for a more complete discussion of uncertainties in MATES III.

   Figure C-1 shows the locations of all known air monitoring stations, including the MATES III fixed stations and the additional SCAB monitors described below:

   - **CARB Air Monitoring Stations -** There are 18 additional regularly-operating CARB Air Monitoring Stations that monitor for a variety of pollutants (e,g. criteria pollutants or air toxics) in the SCAB (9 monitor for $PM_{2.5}$). The data from these stations are available from CARB and can easily be used for comparison to MATES III study $PM_{2.5}$ and $PM_{10}$ estimates. ENVIRON has received EC, $PM_{2.5}$, and $PM_{10}$ data for CARB stations in the SCAB for 2005 and 2006, and included summary statistics on the data, relevant to the analysis presented in this attachment, in the tables and figures below.
   - **POLA/POLB Air Monitoring Stations -** The Ports of Los Angeles and Long Beach operate six additional monitoring stations for one in three day 24-hour average $PM_{2.5}$ and $EC_{2.5}$ readings, among other pollutants and meteorological parameters. The POLA monitors began collecting data and February of 2005 so does fully overlap Year 2 of the MATES III study. However, the POLB monitors did not begin operation until December 2006, which is after completion of the MATES III monitoring. Nonetheless, using results from the Ports' air monitoring can help give a better understanding of air quality near the Ports and coastal areas and to help evaluate the uncertainties associated with the monitoring data used in MATES III. This is especially true as DPM is a major risk-driver in this study and the port area was identified by MATES III as an area with higher than average risk in the SCAB. Given the focus of comments in the MATES III study on DPM and the port area, ENVIRON has included available POLA/POLB data within the closest timeframe of the MATES III study for comparison in the tables and figures below.

For this evaluation, ENVIRON reviewed the data from nearby operating air monitoring stations over the same (or closest similar) time period as the monitoring conducted at the MATES III fixed stations. As can be seen in Figure C-1, there are many additional monitors in the SCAB that collected data that could be used in analyzing the MATES III data. This is most apparent around the San Pedro Bay Ports where four POLA, two POLB, and one CARB station (South Long Beach) collected data relevant to the MATES III analysis (e.g., $PM_{2.5}$ and/or EC), as shown in Figures C-1 to C-6.

As discussed above, the focus of this initial evaluation is on data most relevant to the evaluation of DPM such as the monitoring data for $PM_{2.5}$ and EC that was collected near the Ports. ENVIRON evaluated three different aspects of these data. First, we evaluated how the annual average $PM_{2.5}$ data compared to ambient air quality standards, and how the data compared between the different data sets (i.e., from MATES III, CARB, and POLA/POLB). Second, we evaluated the annual average EC data collected by the Ports' monitors for comparison to MATES III EC data. Finally, we evaluated whether seasonal patterns were apparent in the more discrete 24-hour EC data.

### *1.1 Comparison to Ambient Air Quality Standards*

One general evaluation of this additional monitoring data near the Ports was to determine how $PM_{2.5}$ (which includes DPM) measurements for monitors near the Ports compare to ambient air quality standards. Table C-3 summarizes the California and Federal Ambient Air Quality Standards for $PM_{2.5}$. Tables C-4 and C-5 display air monitoring results of the local air monitoring stations surrounding the Ports for the annual average $PM_{2.5}$ concentrations as well as maximum and minimum recorded 24-hour averages for each year. These tables display the annual average concentration for the nearest full year of data to the MATES III Study Years, with data from 2004-2007. What is striking about the information presented in Tables C-4 and C-5 is that Port monitors located at or nearby Port operations do not show exceedances of the annual NAAQS and only half show exceedances of the annual CAAQS. This is in contrast to the MATES III stations (Wilmington and North Long Beach) that show exceedances of both standards.

The non-MATES III station data shown in Tables C-4 and C-5 indicate that they are all consistently lower than the values reported by the two MATES III stations near the Ports (Wilmington and North Long Beach). This is most directly comparable in the Year 2 data (Table C-5) where POLA-reported annual average $PM_{2.5}$ and maximum 24-hour concentrations are between 23 to 45% and 30 to 50% lower, respectively, than seen at the Wilmington-MATES III station. A similar trend is also apparent in the difference in the values for North Long Beach as reported by CARB (which has more frequent measurements than the MATES III data) that are 5% lower than reported in the MATES III data for the same station. A direct comparison to data collected at the POLB monitors can not be performed since the data were collected after the end of Year 2. However, the eight months of data collected at these monitors do show similar trends to those recorded at the POLA stations.

**Table C-3: National & California Ambient Air Quality Standards**

| | Averaging Time | PM2.5 ($ug/m^3$) |
|---|---|---|
| CAAQS[1] | Annual | 12 |
| | 24-Hr | -- |
| NAAQS[2] | Annual | 15 |
| | 24-Hr | 35 |

Notes
There is no separate 24-hour $PM_{2.5}$ standard in California.

CAAQS = California Ambient Air Quality Standards
NAAQS = National Ambient Air Quality Standards

**Table C-4: Air Monitoring Data Comparison near Los Angeles and Long Beach Ports, PM2.5 (2005) -- MATES III Study, Year 1**

| Site Name | Year | Pollutant | Data Source | Annual Average Concentration (ug/m3) | Exceeds Annual NAAQS Standard? | Exceeds Annual CAAQS Standard? | Max 24-hr Average Concentration | Min 24-hr Average Concentration |
|---|---|---|---|---|---|---|---|---|
| St Peter and Paul School | 2005 | PM2.5 | POLA | 13.1 | | YES | 32.7 | 3.3 |
| Berth 47 | 2005 | PM2.5 | POLA | 10.3 | | | 25.3 | 1.9 |
| Liberty Hill Plaza | 2005 | PM2.5 | POLA | 10.8 | | | 25.7 | 1.9 |
| Terminal Island Treatment Plant | 2005 | PM2.5 | POLA | 14.7 | | YES | 31.4 | 2.5 |
| North Long Beach | 2005 | PM2.5 | CARB | 15.6 | YES | YES | 53.9* | 3.2 |
| Long Beach-East Pacific Coast Highway | 2005 | PM2.5 | CARB | 14.7 | | YES | 50.8* | 1.3 |
| North Long Beach | Year 1 | PM2.5 | MATES III | 18.5 | YES | YES | 61.1* | 4.4 |
| Wilmington | Year 1 | PM2.5 | MATES III | 18.4 | YES | YES | 60.3* | 5.7 |

* Concentrations are higher than the level of the NAAQS, but may not indicate NAAQS exceedences based on the form of the standard.
Notes
MATES III Study: Year 1 = April 2004 - March 2005
POLA Air Monitoring started in February 2005; annual average is based on first available year of data.

[1] CAAQS: http://www.arb.ca.gov/research/aaqs/caaqs/pm/pm.htm
[2] NAAQS: http://epa.gov/air/criteria.html

**Table C-5: Air Monitoring Data Comparison near Los Angeles and Long Beach Ports, PM2.5 (2006) -- MATES III Study, Year 2**

| Site Name | Year | Pollutant | Data Source | Annual Average Concentration (ug/m3) | Exceeds Annual NAAQS Standard? | Exceeds Annual CAAQS Standard? | Max 24-hr Average Concentration | Min 24-hr Average Concentration |
|---|---|---|---|---|---|---|---|---|
| Gull Park | 2006/2007 | PM2.5 | POLB | 10.9 | | | 37.2* | 2.6 |
| Super Block | 2006/2007 | PM2.5 | POLB | 14.1 | | YES | 38.3* | 1.8 |
| St Peter and Paul School | Year 2 | PM2.5 | POLA | 13.0 | | YES | 34.6 | 3.0 |
| Berth 47 | Year 2 | PM2.5 | POLA | 10.3 | | | 25.9 | 1.3 |
| Liberty Hill Plaza | Year 2 | PM2.5 | POLA | 10.9 | | | 25.7 | 1.6 |
| Terminal Island Treatment Plant | Year 2 | PM2.5 | POLA | 14.1 | | YES | 31.4 | 2.5 |
| North Long Beach | Year 2 | PM2.5 | CARB | 16.4 | YES | YES | 53.9* | 3.5 |
| North Long Beach | 2006 | PM2.5 | CARB | 14.1 | | YES | 58.5* | 3.4 |
| Long Beach-East Pacific Coast Highway | Year 2 | PM2.5 | CARB | 14.8 | | YES | 49.5* | 4.1 |
| Long Beach-East Pacific Coast Highway | 2006 | PM2.5 | CARB | 14.3 | | YES | 53.6* | 3.5 |
| North Long Beach | Year 2 | PM2.5 | MATES III | 17.2 | YES | YES | 55.8* | 3.7 |
| Wilmington | Year 2 | PM2.5 | MATES III | 18.3 | YES | YES | 49.7* | 4.8 |

* Concentrations are higher than the level of the NAAQS, but may not indicate NAAQS exceedences based on the form of the standard.

Notes
MATES III Study: Year 2 = April 2005 - March 2006
POLB data are limited to an 8-month monitoring period (December 2006 - July 2007)

The 2005 POLA annual average $PM_{2.5}$ and maximum 24-hour $PM_{2.5}$ concentrations are between 20 to 45% and 45 to 65% lower, respectively, than seen at the Wilmington-MATES III station for Year 1 (see Table C-4). Although the MATES Year 1 data collection only occurred during part of 2005, these differences still appear significant as the CARB reported 2005 annual average $PM_{2.5}$ and maximum 24-hour concentrations that are 15% and 12% lower, respectively, than seen at the North Long Beach-MATES III station during Year 1.

The annual average $PM_{2.5}$ concentrations measured near the Ports were spatially placed, as shown in Figures C-3 and C-4 for Year 1 and 2, respectively. Figure C-2 includes wind roses for local meteorological stations around POLA/POLB where wind speed and wind direction data were available. These windroses help analyze wind patterns and possible emission sources and air dispersion trends using multiple years of data, where available, to indicate overall trends in these parameters. For most stations near POLA/POLB, the wind is predominantly from the northwest and secondarily from offshore (generally from the south). Because of this, if the on-port sources are the predominant source of $PM_{2.5}$ in the local area, then one might expect to see concentrations of $PM_{2.5}$ increase as you move northward over an increasingly larger portion of Port operations. However, as shown in Figures C-3 and C-4, the most northern Port monitors are measuring lower annual average $PM_{2.5}$ concentrations than stations located near terminal operations in the harbor, and all are lower than the values reported for the MATES III stations near the Ports.

These observations indicate that more immediate sources of $PM_{2.5}$ emissions may be influencing these monitors to a greater degree than more sub-regional impacts from on-port operations. Further study is warranted to evaluate potential source contribution to these monitors. Such a study could be similar to the localized studies performed in MATES II to evaluate more localized "hotspots." Without these additional studies or further evaluation of these potential inconsistencies, drawing conclusions on whether the PM and EC concentrations at monitors near the Port operations are due to the sub-regional impacts from Port operations or due to a more localized specific source(s) can not be made. This also indicates that conclusions in the MATES III Report about the impact of port sources farther away from the Ports (such as in Central Los Angeles, or even further downwind) may also warrant re-consideration. At the very least, the uncertainty in measured concentrations and the inability to draw more definitive conclusions on source contributions to individual monitors should be discussed in the final MATES III report.

### *1.2 Comparison to EC Data Nearby the Ports*

In addition to the $PM_{2.5}$ data, ENVIRON evaluated the $EC_{2.5}$ data collected by the Ports' monitors for comparison to MATES III EC data. Tables C-6 and C-7 display air monitoring results of the local air monitoring stations surrounding the Ports for the annual average EC concentrations as well as maximum and minimum recorded 24-hour averages for each year. These tables provide the average concentrations for the nearest full year of data to the MATES III Study Years, with data from 2004-2007. Figures C-5 and C-6 show annual average EC concentrations for Year 1 and Year 2 of the MATES III study, for stations around POLB and POLA. Although all the monitors do not have one overlapping time period of collection (except for Year 2 MATES III and POLA monitors), general observations on these data sets can be made.

Similar to the discussion above in ENVIRON's evaluation of the $PM_{2.5}$ data, if the Ports are the predominant sub-regional source of EC in the local area, then one might expect to see concentrations of EC increase as you move northward over an increasingly larger portion of Port operations. As shown in these figures, the highest monitored MATES III EC concentrations nearby the Ports are consistently at the Wilmington MATES III station. However, the Wilmington annual average EC data are more consistently similar to Port monitors located in the middle of on-port operations, Terminal Island Treatment Plant and Super Block, rather than with the more northern Port monitors. For example, Port monitors at or just past the boundaries of the Ports (St. Peter and Paul School, Liberty Hill Plaza, and Gull Park) are more similar to the EC concentrations seen at the North Long Beach MATES III Station, which is about 30% lower than the Wilmington station.

The observations described above, in addition to those described in the preceding section on $PM_{2.5}$, lend further support to the possibility that more immediate sources of DPM emissions may be influencing these monitors to a greater degree than sub-regional impacts from on-port operations. As discussed previously, further study (potentially similar to those conducted to evaluate localized sources in MATES II) is warranted to evaluate potential source contribution to these monitors. Without such studies or further evaluation of these potential inconsistencies, drawing conclusions with respect to whether the monitors near the Port operations are reflecting results that are attributable to the regional impacts from all Port operations or due to a more localized specific source(s) can not be made. At the very least, the uncertainty in measured concentrations and the inability to draw more definitive conclusions regarding source contributions to individual monitors should be discussed in the final MATES III report, given that source attribution information is an important piece of data used for risk management decisions.

**Table C-6: Air Monitoring Data Comparison near Los Angeles and Long Beach Ports Elemental Carbon (2005) - MATES III Study, Year 1**

| Site Name | Year | Pollutant | Data Source | Annual Average Concentration (ug/m3) | 24-Hr Max Concentration (ug/m3) | 24-Hr Min Concentration (ug/m3) |
|---|---|---|---|---|---|---|
| St Peter and Paul School | 2005 | EC-PM2.5 | POLA | 1.43 | 5.20 | 0.00 |
| Berth 47 | 2005 | EC-PM2.5 | POLA | 0.98 | 3.70 | 0.10 |
| Liberty Hill Plaza | 2005 | EC-PM2.5 | POLA | 1.44 | 6.70 | 0.10 |
| Terminal Island Treatment Plant | 2005 | EC-PM2.5 | POLA | 2.46 | 8.10 | 0.20 |
| North Long Beach | Year 1 | EC-PM2.5 | MATES III | 1.46 | 5.99 | 0.04 |
| Wilmington | Year 1 | EC-PM2.5 | MATES III | 2.03 | 8.40 | 0.02 |

Notes
MATES III Study: Year 1 = April 2004 - March 2005
POLA Air Monitoring started in February 2005, annual average based on first available year of data.

**Table C-7: Air Monitoring Data Comparison near Los Angeles and Long Beach Ports, Elemental Carbon (2006) - MATES III Study, Year 2**

| Site Name | Year | Pollutant | Data Source | Annual Average Concentration (ug/m3) | 24-Hr Max Concentration (ug/m3) | 24-Hr Min Concentration (ug/m3) |
|---|---|---|---|---|---|---|
| Gull Park | 2007 | EC-PM2.5 | POLB | 1.57 | 6.62 | 0.09 |
| Super Block | 2007 | EC-PM2.5 | POLB | 2.61 | 10.84 | 0.34 |
| St Peter and Paul School | Year 2 | EC-PM2.5 | POLA | 1.56 | 5.20 | 0.00 |
| Berth 47 | Year 2 | EC-PM2.5 | POLA | 1.07 | 4.60 | 0.10 |
| Liberty Hill Plaza | Year 2 | EC-PM2.5 | POLA | 1.52 | 6.70 | 0.20 |
| Terminal Island Treatment Plant | Year 2 | EC-PM2.5 | POLA | 2.52 | 9.30 | 0.20 |
| North Long Beach | Year 2 | EC-PM2.5 | MATES III | 1.49 | 5.27 | 0.35 |
| Wilmington | Year 2 | EC-PM2.5 | MATES III | 2.12 | 8.78 | 0.31 |

Notes
MATES III Study: Year 2 = April 2005 - March 2006
POLB Data is limited to 8-month monitoring period (December 2006 - July 2007)

### *1.3 Evaluation of Seasonal Patterns*

At the March 13, 2008 TAG meeting, several significant technical issues were raised. One TAG comment further explored in ENVIRON's analysis was the potential impact of higher EC emissions from spark-ignited engines during periods of lower seasonal temperatures (below 70 degrees Fahrenheit). If such differences in EC emissions exist, they maybe reflected in seasonal trends and could affect the conclusions of the MATES III Report. To analyze this issue, Figures C-7 and C-8 provide graphs of the temporal variations in 24-hour average EC measurements from all MATES III stations and specific Port-area air monitoring stations, respectively. These graphs show temporal trends in EC concentrations that may be due to varying operations throughout the year, meteorology (e.g., lower mixing heights in the fall / winter) or, variation in the exhaust profiles in colder months as noted during the TAG meeting (e.g., greater contribution of spark-ignited EC in colder months). As shown in Figures C-7 and C-8, measured EC concentrations are roughly two times higher in the winter months when temperatures would be consistently below 70 degrees Fahrenheit (between October and February) than in the warmer summer months. If spark-ignited engines are a proportionally greater contributor to EC emissions during winter months, the MATES III study may be overestimating the contribution of DPM (and hence, DPM risk) in its monitored data risk analysis (i.e., the current MATES III approach does not address the seasonality of the EC ratio between diesel and spark-ignited engines). Further study and analysis of this issue is critical given that source attribution information is an important piece of data used for risk management decisions. Additionally, depending on the outcome of such an analysis, some of the conclusions that are currently in the draft MATES III report could change, requiring incorporation into the final (revised) MATES III report..

2. **Lack of Agreement in Air Monitoring Data and CMB Results**
   The MATES III results suggest that total reconstructed $PM_{2.5}$ levels using CMB and either of the gasoline profiles used by SCAQMD are consistently higher than measured levels at all ten sites. Except in three instances, $PM_{2.5}$ levels predicted using CMB were 1% to 18% higher, see Table C-8. Most notably, the Wilmington site has both the highest overestimated value (18% using the NFRAQS profile in year 1) and highest average overestimation over the two years and two profiles (11%). As described in more detail in our comments on the CMB method (see Attachment B), some of the mass associated with the various source categories may be overestimated, and this applies especially to any carbon-rich sources, such as diesel, gasoline, biomass burning, meat cooking, and oil burning. Thus, any overestimation in these categories, which includes DPM, by the CMB approach, would result in overestimated risk and most notably at the Wilmington site that is nearest to the Ports.

**Table C-8: Comparison of CMB Predicted versus Measured Ambient $PM_{2.5}$ Concentrations in MATES III Study[1]**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **NFRAQS Gasoline Profile (Year 1) [Appendix VII - Table 1]** | | | | | | | | | | |
| Station | Wilmington | N. Long Beach | Compton | Huntington Park | Los Angeles | Pico Rivera | Burbank | Anaheim | Fontana | Rubidoux |
| Predicted | 20.94 | 19.59 | 21.91 | 23.85 | 21.2 | 21.98 | 21.55 | 18.2 | 22.64 | 22.93 |
| Measured | 17.72 | 18.41 | 19.34 | 22.2 | 19.38 | 20.6 | 21.21 | 17.55 | 21.35 | 23.54 |
| % Difference (Predicted vs. Measured) | 18% | 6% | 13% | 7% | 9% | 7% | 2% | 4% | 6% | -3% |
| **NFRAQS Gasoline Profile (Year 2) [Appendix VII - Table 3]** | | | | | | | | | | |
| Station | Wilmington | N. Long Beach | Compton | Huntington Park | Los Angeles | Pico Rivera | Burbank | Anaheim | Fontana | Rubidoux |
| Predicted | 19.89 | 17.88 | 19.49 | -- | 19.7 | -- | 21.16 | 17.74 | 23.07 | 23.16 |
| Measured | 18.1 | 16.74 | 17.66 | -- | 17.4 | -- | 19.97 | 16.8 | 20.98 | 21.8 |
| % Difference (Predicted vs. Measured) | 10% | 7% | 10% | -- | 13% | -- | 6% | 6% | 10% | 6% |
| **SCAB Gasoline Profile (Year 1) [Appendix VII - Table 2]** | | | | | | | | | | |
| Station | Wilmington | N. Long Beach | Compton | Huntington Park | Los Angeles | Pico Rivera | Burbank | Anaheim | Fontana | Rubidoux |
| Predicted | 19.98 | 18.89 | 20.83 | 22.89 | 20.73 | 21.42 | 20.93 | 17.65 | 22.33 | 22.5 |
| Measured | 17.72 | 18.41 | 19.34 | 22.2 | 19.38 | 20.6 | 21.21 | 17.55 | 21.35 | 23.54 |
| % Difference (Predicted vs. Measured) | 13% | 3% | 8% | 3% | 7% | 4% | -1% | 1% | 5% | -4% |
| **SCAB Gasoline Profile (Year 2) [Appendix VII - Table 4]** | | | | | | | | | | |
| Station | Wilmington | N. Long Beach | Compton | Huntington Park | Los Angeles | Pico Rivera | Burbank | Anaheim | Fontana | Rubidoux |
| Predicted | 18.96 | 17.18 | 18.55 | -- | 19.27 | -- | 20.08 | 17.25 | 22.58 | 22.76 |
| Measured | 18.1 | 16.74 | 17.66 | -- | 17.4 | -- | 19.97 | 16.81 | 20.98 | 21.8 |
| % Difference (Predicted vs. Measured) | 5% | 3% | 5% | -- | 11% | -- | 1% | 3% | 8% | 4% |
| **All Profiles - Years 1 and 2** | | | | | | | | | | |
| **Average % Difference (Predicted vs. Measured)** | 11% | 5% | 9% | 5% | 10% | 5% | 2% | 3% | 7% | 1% |

[1] South Coast AQMD, "Multiple Air Toxics Exposure Study: Appendix VII. $PM_{2.5}$ Source Apportionment for the South Coast Air Basin Using Chemical Mass Balance Receptor Model", http://www.aqmd.gov/prdas/matesIII/draft/appVII.pdf (viewed January 22, 2008).

**3. Lack of Comparison Between Monitoring and Modeling Results**

As described in more detail in ENVIRON's review of the MATES III air quality modeling (see Attachment D), the main text of the study did not fully compare specific monitoring site results to the results predicted by the model at these locations. The modeling appendix to the report, released 3 weeks after the main report, do provide additional detail in this area, but our review of the modeling appendix indicates that it does not contain the level of discussion and detail necessary. As discussed in Attachment D, there appears to be discrepancies between the modeled and monitored risk that should be investigated and explained. In fact, rough comparisons using approximate monitored risk values from Figures 2-17 and 2-18 and modeling results data in Table 4-5 of the study indicate that modeling results at some stations (Burbank, Fontana, and Rubidoux) may be a factor of two lower than results from the monitoring data while other stations (Wilmington and North Long Beach) are overestimated by 10% to 30% than shown by the monitoring results, see Table 4. To address the comparability of the two methods, the modeled and monitored risks (and pollutant concentrations) need to be compared on a station by station basis and any differences between the two should be fully discussed as sources of potential uncertainty in the analysis. However, SCAQMD is just releasing the discrete modeling results (in electronic format) necessary to perform this review. Based on this data further analyses should be conducted to resolve these issues.

**Table C-9: Comparison of Modeled versus Measured Risk Levels in MATES III Study.**

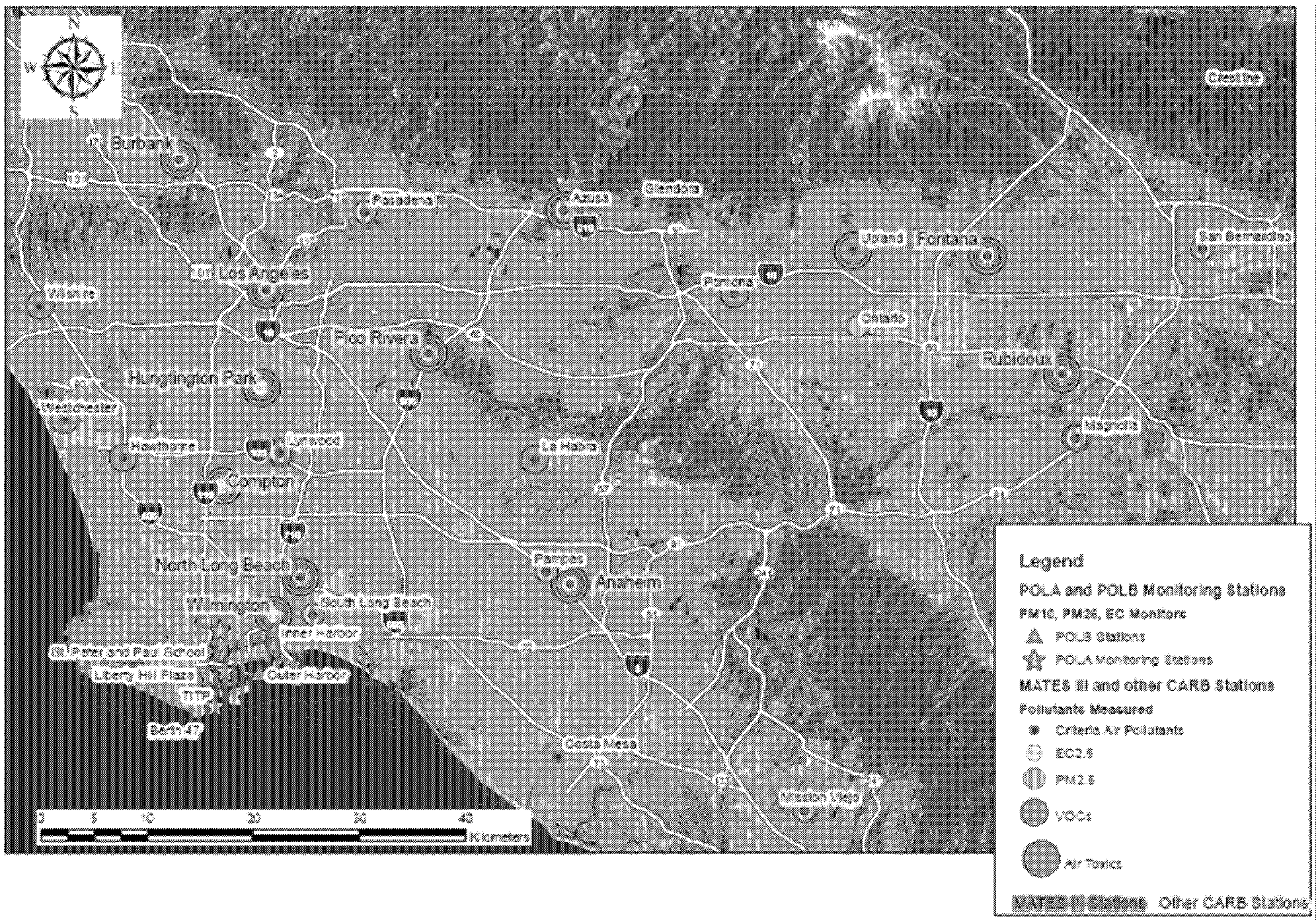
| Location | 2005 Modeled Risks[1] | Monitored Risk | | | Modeled/ Monitored | Modeled Risk Higher/Lower? |
|---|---|---|---|---|---|---|
| | | Year 1[2] | Year 2[3] | Average | | |
| Wilmington | 1415 | 1175 | 1350 | 1263 | 1.12 | Higher |
| Long Beach | 1242 | 900 | 975 | 938 | 1.32 | Higher |
| Compton | 973 | 1100 | 1200 | 1150 | 0.85 | Lower |
| Los Angeles | 1268 | 1100 | 1450 | 1275 | 0.99 | Lower |
| Burbank | 645 | 1200 | 1400 | 1300 | 0.50 | Lower |
| Anaheim | 882 | 800 | 950 | 875 | 1.01 | Higher |
| Fontana | 681 | 1250 | 1575 | 1413 | 0.48 | Lower |
| Rubidoux | 545 | 1000 | 1300 | 1150 | 0.47 | Lower |

Notes:

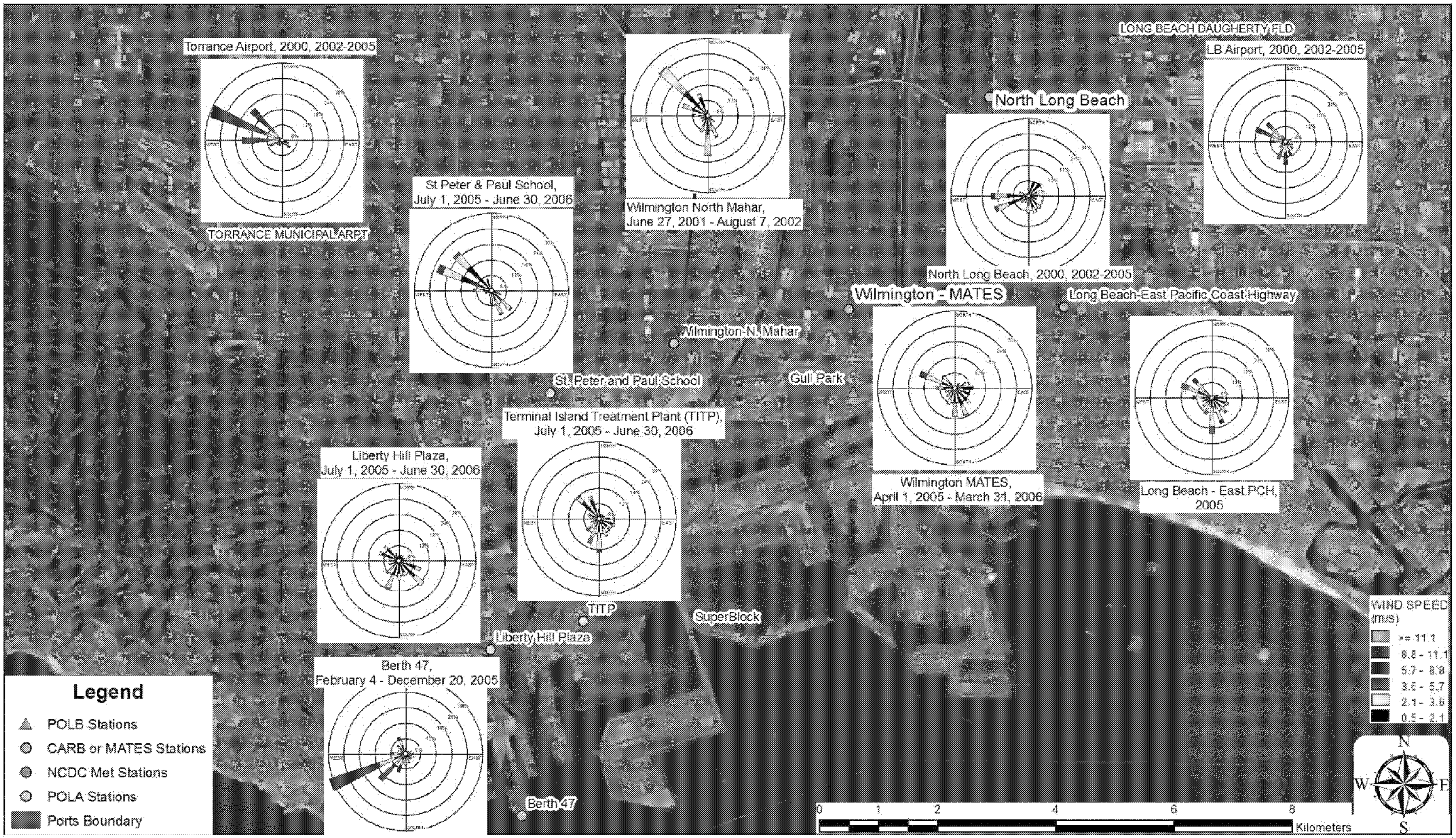
1. MATES III: Table 4-5
2. MATES III: Figure 2-17
3. MATES III: Figure 2-18

Additional Note: The stations are grouped by distance from the Ports.

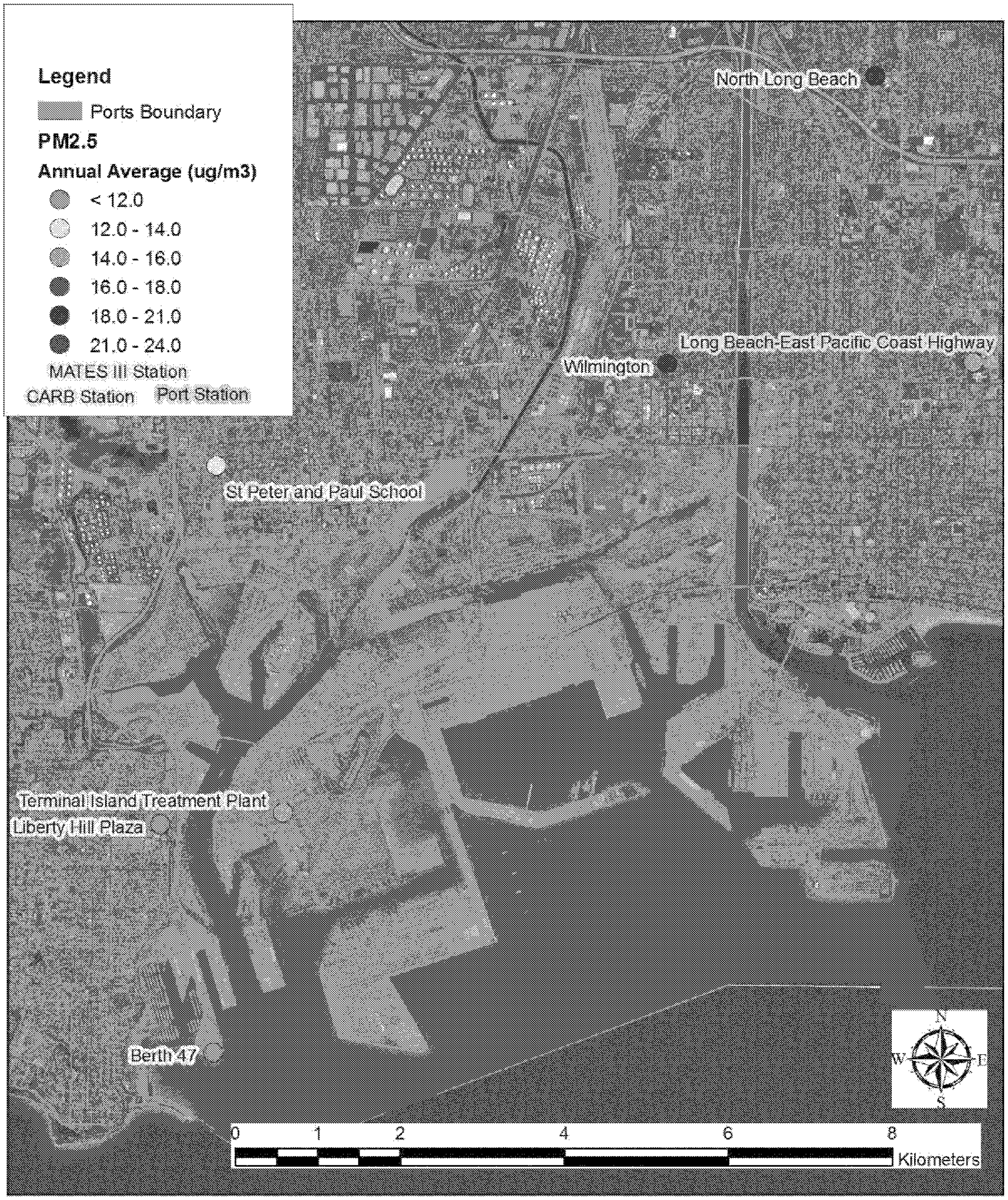
## Figure C-1: Air Monitoring Stations in the South Coast Air Basin.
## MATES III Study Comparison
## South Coast Air Basin, California



## Figure C-2: Meteorological Stations and Wind Patterns around POLA and POLB
## MATES III Study Comparison
## South Coast Air Basin, California



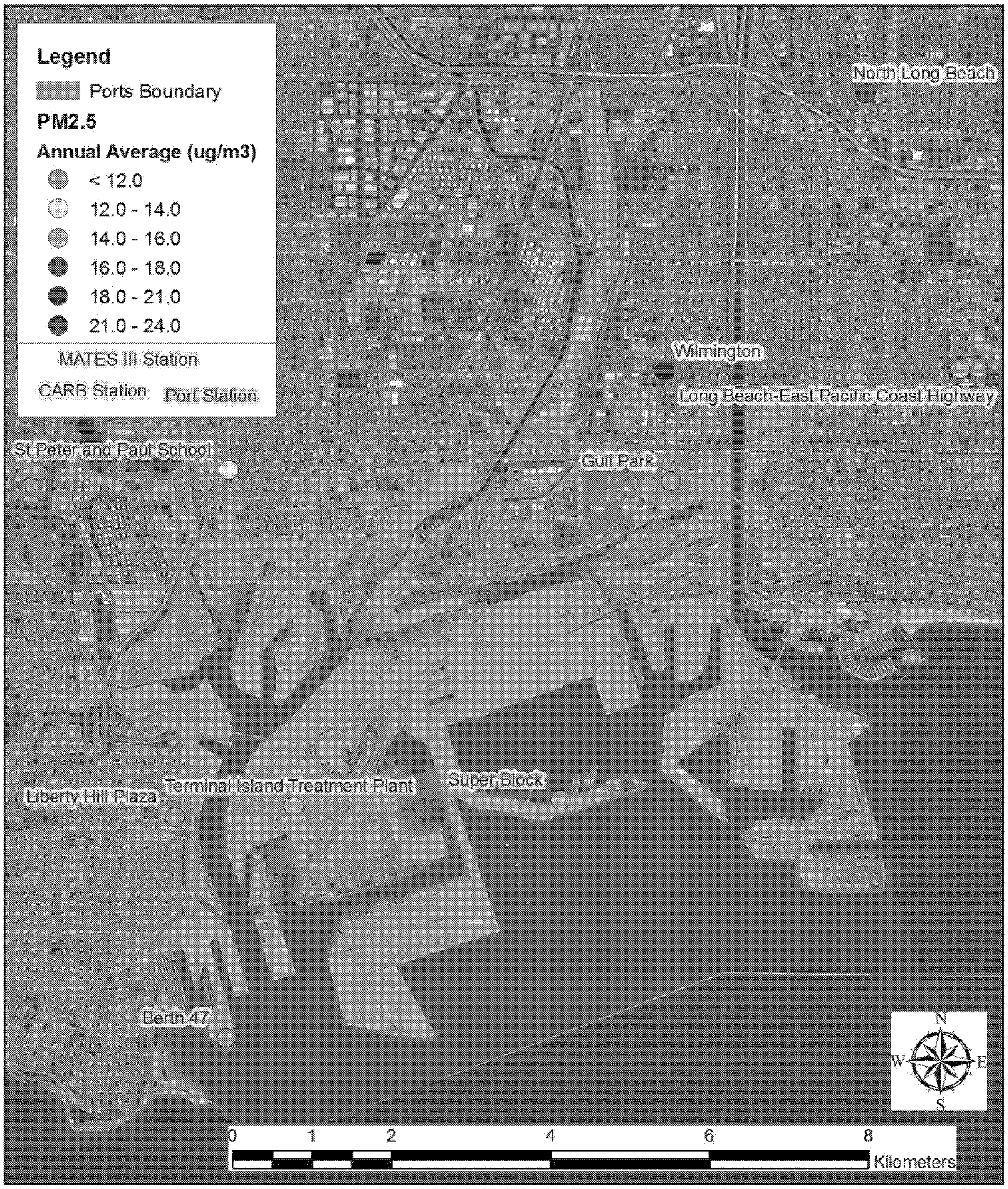
## Figure C-3: Air Monitoring Stations around POLA and POLB
## PM2.5 Year 1 (2005)
## South Coast Air Basin, California




ENVIRON

Notes:
MATES III Study, Year 1: April 2004 - March 2005
POLA Air Monitoring started February 2005, annual average based on first available year of data.

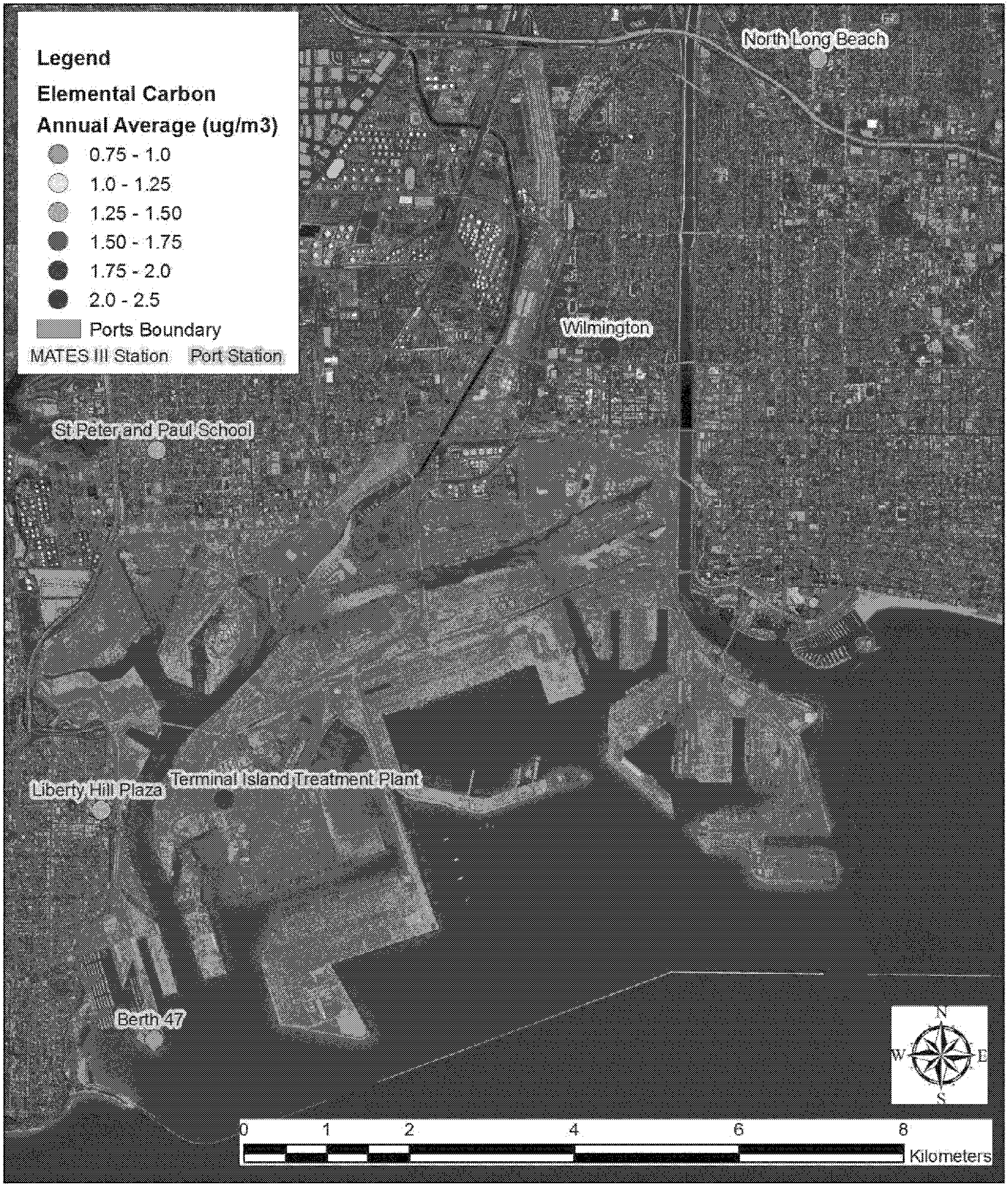
## Figure C-4: Air Monitoring Stations around POLA and POLB PM2.5 Year 2 (2006) South Coast Air Basin, California




ENVIRON

Notes:
MATES III Study, Year 2: April 2005 - March 2006
POLB Data is limited to 8-month monitoring period (December 2006 - July 2007)

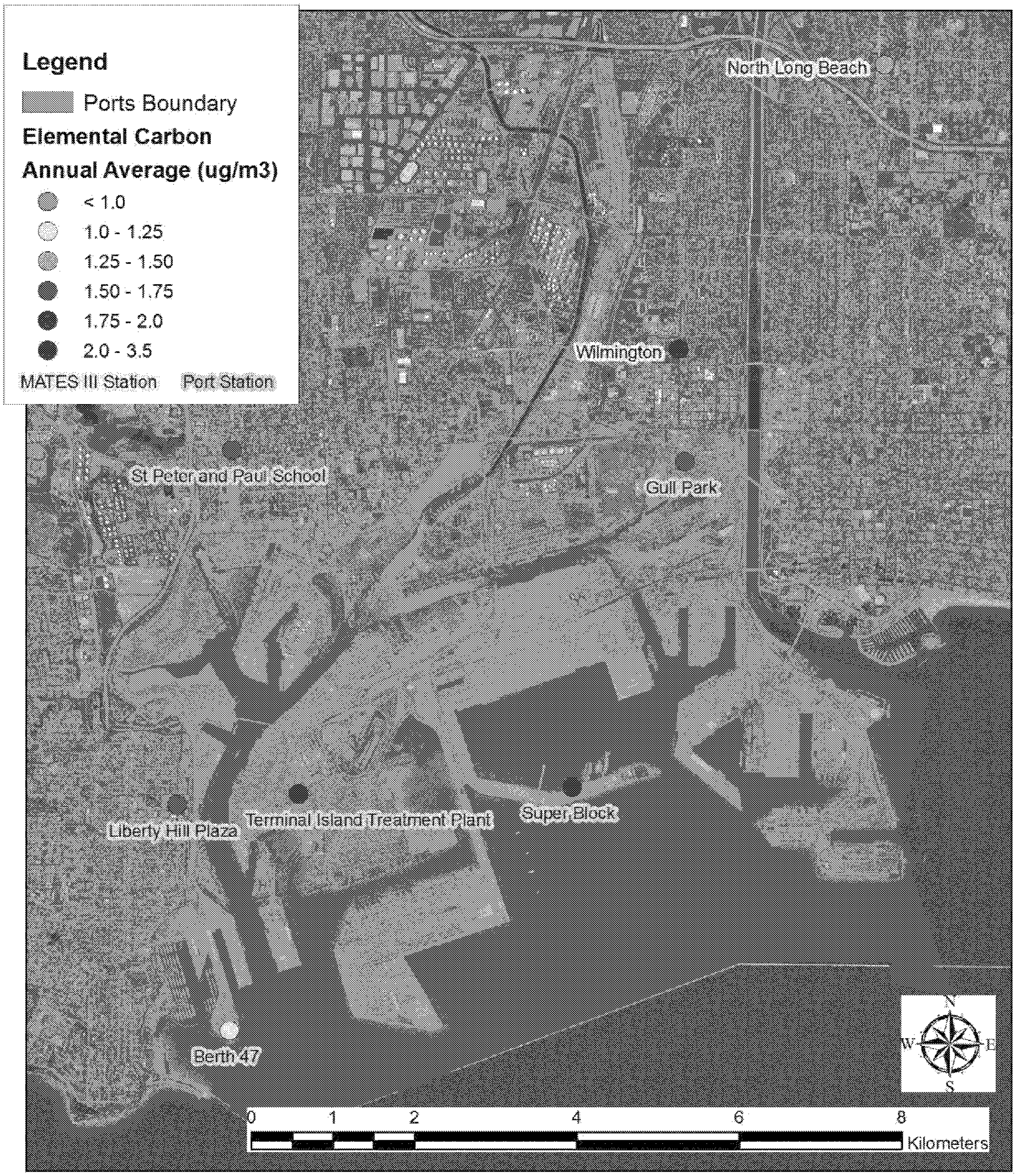
# Figure C-5: Air Monitoring Stations around POLA and POLB Elemental Carbon, Year 1 (2005) South Coast Air Basin, California




ENVIRON

Notes:
MATES III Study, Year 1: April 2004 - March 2005
POLA Air Monitoring Data started in February 2005, annual average based on first available year of data.

## Figure C-6: Air Monitoring Stations around POLA and POLB Elemental Carbon Data Comparison – MATES III Year 2 (2006) South Coast Air Basin, California




ENVIRON

**Notes:**
MATES III Study, Year 2: April 2005 - March 2006
POLB Data is limited to 8-month monitoring period (December 2006 - July 2007)

**Figure C-7. Concentration of Elemental Carbon, April 2004 - March 2006 (MATES III Monitoring Stations)**

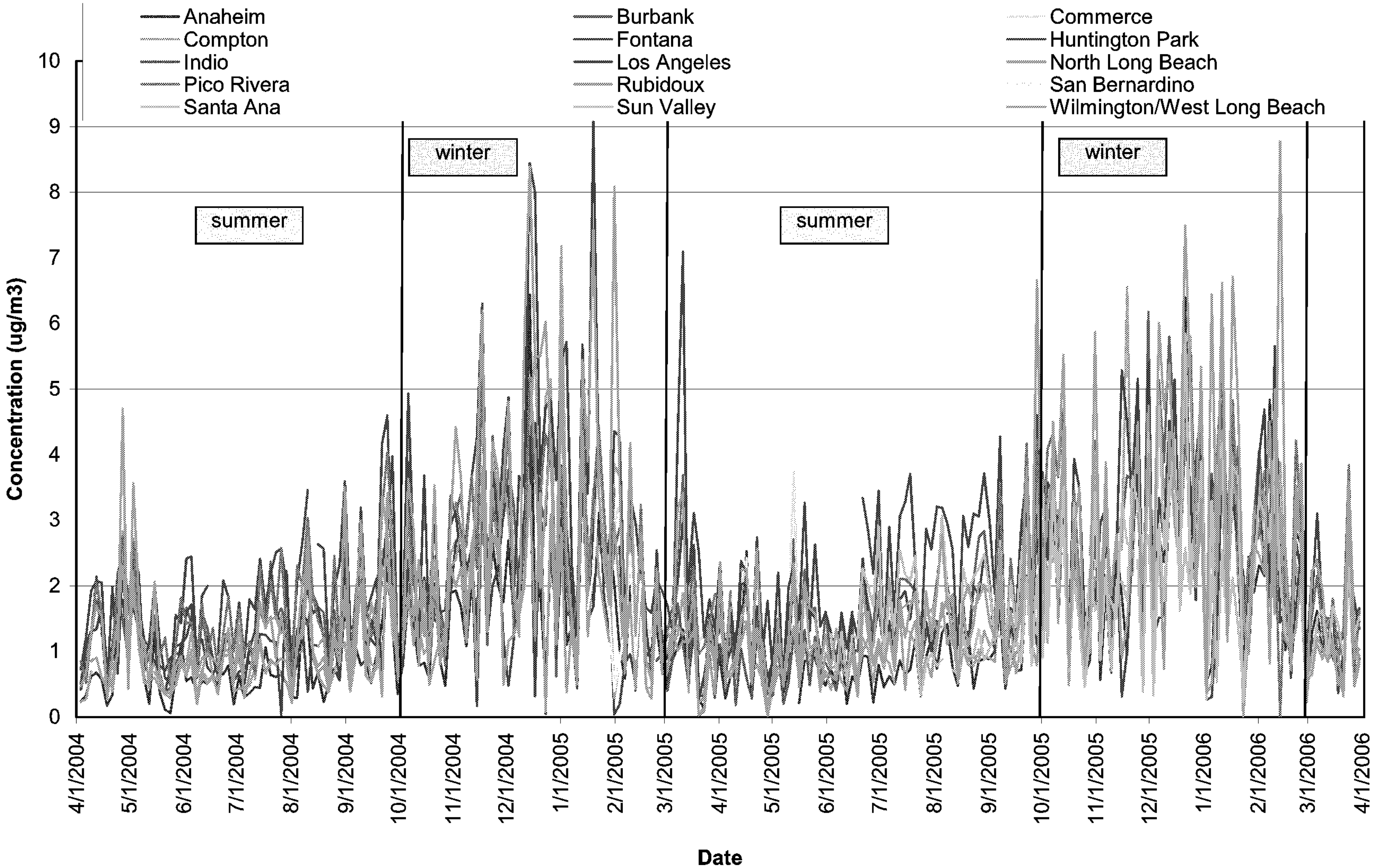
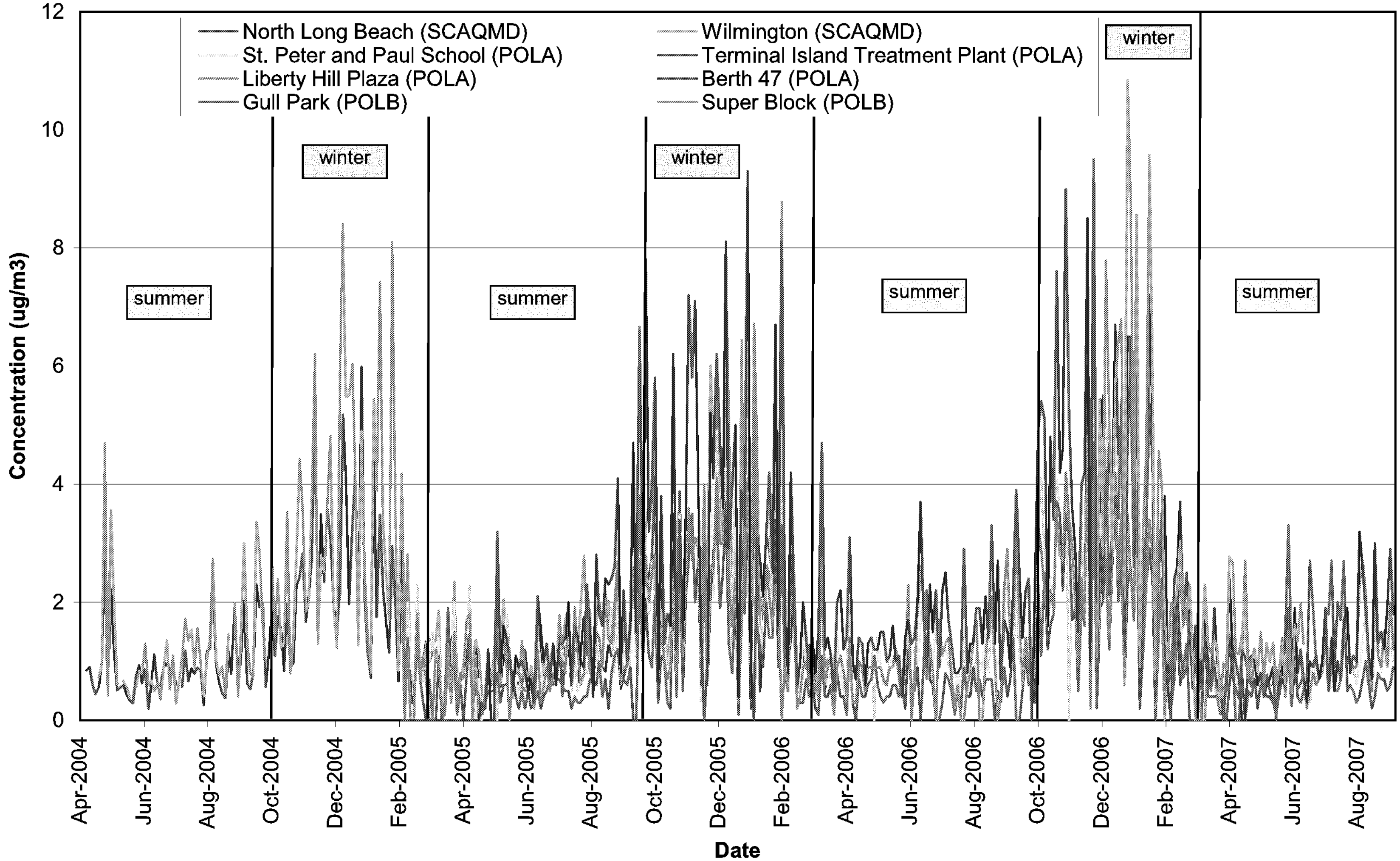


**Figure C-8. Concentration of Elemental Carbon, Port-Area Monitoring Stations (April 2004 - September 2007)**



# Attachment D:
# Review of the MATES III Regional Modeling Effort

## Background

MATES III performed modeling of toxic compounds using the Comprehensive Air-quality Model with extensions (CAMx) (ENVIRON, 2006; www.camx.com) for the calendar year 2005. The CAMx modeling domain covered the South Coast Air Basin (Basin) using a 2 km grid resolution. The Reactive Tracer (RTRAC) probing tool in CAMx was used to model air toxics species, following an approach developed by ENVIRON (Morris, Lau and Yarwood, 2003; http://www.camx.com/publ/pdfs/ATModelSys69437.pdf). In RTRAC, the air toxics compounds are modeled in parallel to the CAMx host photochemical grid model using the same transport, dispersion, chemical transformation, and deposition algorithms. For those compounds that are chemically reactive (e.g., formaldehyde, benzene, 1,3-butadiene), the chemical reaction rates are extracted from the CAMx chemistry module and applied to the RTRAC tracers. Those secondarily formed air toxics compounds (e.g. formaldehyde and acetaldehyde) that are also formed by the CAMx chemistry module are added to the RTRAC tracers for further tracking.

Although the MATES III report was released on January 4, 2008, when the SCAQMD initiated the 90 day comment period, Appendix IX, which documented the MATES III modeling, was not released until January 25, 2008. However, the documentation of the MATES III regional modeling in that Appendix was not sufficient to explain the technical approach and also contained some errors. In response to a request for the MATES III regional model inputs and outputs, emissions modeling database, and interim modeling data files, the SCAQMD provided only the MATES III modeling inputs, which were received March 26, 2008. However, some of the modeling inputs were missing. SCAQMD staff was subsequently contacted, and they provided the missing input data on March 28, 2008. Thus, there was insufficient time available to rerun the MATES III regional modeling database or to provide a review of the output files (to be delivered) before the comments due date of April 4 2008. Based on communication from the District's Executive Officer, ENVIRON will continue to work with District staff after the April 1$^{st}$ commenting deadline to review, assess, and comment on the technical issues raised in this and the other attachments.

## Key Findings on MATES III Regional Modeling

The following were the key findings of the review of the MATES III regional modeling that were gleaned from an examination of the MATES III report and a preliminary review of the MATES III modeling inputs.

- There are inconsistencies between the MATES III documentation on the regional modeling (e.g., Appendix IX) and the actual regional modeling inputs received from the SCAQMD (e.g., there are 7 vertical layers in the documentation but the inputs have 8 layers). More time is needed to examine and rerun the MATES III modeling prior to commenting, as one week is insufficient time to perform such a complex review and analysis

- There are inconsistencies between the risks calculated in the MATES III monitoring and modeling analyses, particularly on a station-by-station basis. As noted in Attachment C, modeled concentrations (and related risk calculations) are systematically higher for coastal and central Los Angeles areas, and systematically lower at inland areas (Burbank, Fontana and Riverside). The draft Report discusses the gross error in Basin-average modeled concentrations, but does not discuss the bias and gross error on a station-by-station basis in sufficient detail. This is important if the modeling results are to be used to apportion elevated risk levels to specific sources or source categories.

- There were differences in how emissions from marine vessels were treated in calculations of MATES III monitored and modeled risk. In the CMB analysis, ship emissions were characterized by the Residual Oil Burning (ROB) category; in the regional modeling analysis, ship emissions were characterized as DPM. ENVIRON would like to work with the District staff to understand better the rationale and effect of these differences.
- There are inconsistencies on how the monitored and modeled risks were calculated between MATES II and MATES III, making their comparison difficult. However, comparisons of the monitored risk made using a consistent methodology (i.e., MATES II DMP/EC ratio method) we observe that the average risk is reduced by 40% from MATES II to MATES III (District monitoring staff has stated that approximately 10% of this difference is likely the result of changes to the monitors). However, the modeled risk reduction between MATES II and MATES III is only 17%. The SCAQMD recognizes that the change in methodologies between MATES II and MATES III makes a comparison of their risks difficult and is going back to remodel MATES II using the MATES III modeling methodology. We understand that the District has no plans at this time to perform a similar update for the monitored risk. ENVIRON will continue its review of this issue when the revised Appendix IX report and related data are released.

### Notes on MATES II modeling

In MATES II, an annual period from 1997-1998 was modeled using the UAM-Tox model and a 2 km grid resolution on a smaller domain than used in MATES III. ENVIRON reviewed the MATES II air toxics modeling and analysis for the City of Los Angeles and found, among other things:

- Important limitations of the toxics risk modeling results were not presented. For example, we found that the air toxics modeling database used by the SCAQMD would produce toxic risk of over 200 in a million even without any toxics emissions in the Basin just due to long-range transport of air toxics.
  - In these cases relative changes between model runs may then be more realistic indicators of, for example, control strategies. For these comparisons the model's lower bound of estimated risk needs to be clearly stated and discussed so that it can be accounted for when looking at relative model response.
- There were discrepancies between the MATES II inventories and those used in the 1997 AQMP (ozone and PM SIP modeling).
  - The SIP and its emission projections and controls are legally enforceable. There was no explanation why the MATES II air toxics modeling used different assumptions and

emissions. From our preliminary analysis of MATES III, it appears the SCAQMD did use an inventory consistent with the 2007 AQMP.

- There were discrepancies in the risk calculations between the monitored and modeled risk estimates.
  - The monitored/modeled risk differences were not reconciled or explained in MATES II; as a result, some doubt arises as to which risk estimates are more accurate. As noted in other Attachments in this initial review, the SCAQMD did compare MATES III monitoring and modeling data, but the evaluation is limited in scope.

**Initial Review of MATES III Modeling Results**

A major change in the methodology between MATES II and MATES III concerns how the monitored diesel particulate matter (DPM) surrogate was derived. In MATES II, a basin-wide DPM/EC scaling factor was developed ($DPM/EC_{10} = 1.04$) so that DPM concentrations could be estimated directly from the elemental carbon ($EC_{10}$) observations (MATES II DPM/EC ratio method). In MATES III, the Chemical Mass Balance (CMB) receptor model was used to estimate the amount of DPM from the PM measurements using source profiles. The MATES III DPM estimation procedure using CMB resulted in much higher DPM concentrations and consequently, risk due to DPM, as well as total risk, was higher than using the MATES II DPM/EC ratio method. Despite the differences in DPM derivation methodologies in MATES II and MATES III, and the SCAQMD's caveat that the basin-wide risk between the two studies can not be compared due to the differing DPM methodologies, the MATES III reports makes such comparisons anyway such as (see page 2-10):

- Average risk in MATES III is ~1,200 in a million compared to ~1,400 in a million in MATES II (a 14% reduction).
- DPM contributes 84% of the risk in MATES III and 70% of the risk in MATES II.

As discussed below, a consistent comparison of the monitored risk between MATES II and MATES III can be made using the MATES II DPM/EC ratio method which reveals a 40% reduction in risk between the two studies. (As noted above, District monitoring staff has attributed about 10% of this change to differences between the MATES II and MATES III monitors.)

A preliminary observation is that the regional modeling in the DRAFT MATES III report is treated in almost complete isolation from the other analyses. MATES III presents the emissions inventory development, CMB DPM derivation, the monitored risk calculations, and the modeled risk calculations as separate analyses and, as noted throughout this letter, there is only a limited attempt to integrate the different types of analyses together to see if they corroborate each other. The regional air toxics model is really just a sophisticated data analysis tool that can bring closure between the emissions, atmospheric processes and measurements. In MATES II the only attempt at such closure was in the model performance evaluation. However, numerous discrepancies between the MATES II monitoring and modeling were presented and left unexplored and unexplained. In what could be inferred from the modeling results presented in the main MATES III report, there are also additional inconsistencies and discrepancies between the modeling and monitoring that raise doubts about both methods being utilized. These issues, which generally fall under the category of insufficient evaluation of the model, are discussed in more detail in the next few paragraphs.

Table D-1 below lists the basin-wide average risk from MATES III calculated from the monitoring data using the MATES III DPM and MATES II DPM/EC ratio method and from the MATES III modeling. The MATES III modeled risk is 32 percent lower than the MATES III monitored risk using the CMB method. Surprisingly, using the DPM/EC ratio method and the MATES III data results in much closer agreement between the monitored and modeled risk in MATES III (within 3%). The reasons for the differences in the monitored and modeled risk in MATES III are not fully explained.

**Table D-1: MATES III Basin-Wide Average Risk (per million) Estimated using the Monitoring Data and the MATES III CMB and MATES II DPM/EC DPM Derivation Method and the MATES III Modeling**

| Monitored CMB | Monitored DPM/EC | Modeled |
|---|---|---|
| 1,194 | 839 | 812 |

The comparison of the risk from MATES II and MATES III is an essential component of the MATES III study. The MATES III report notes that because of changes in methodology in how the monitored and modeled risks were derived in the two studies, their risks can not be compared. Although not presented in the MATES III report, Table D-2 compares the monitored and modeled basin-wide average risk between MATES II and MATES III using consistent methodologies to derive the monitored risk in the two studies. In this case, the MATES II DPM/EC ratio method was used to calculate monitored risk between the two studies. The preferred approach would be to also use the MATES III DPM approach with MATES II data; however such information was not available using the MATES II data. At the March 13, 2008 TAG meeting the SCAQMD noted that they were not going to go back and develop monitored risk for MATES II using the MATES III methodology. However, they are going to go back and apply the MATES III modeling methodology for the MATES II period so they will have consistent modeled risk between the two studies sometime in the future. Using the monitoring data and the DPM/EC ratio approach, there is a 40% reduction in risk between MATES II and MATES III. However, the modeling only estimates a 17% reduction, less than half of the reduction of the monitoring. The reasons for the large differences in risk reduction between these two methods is not fully explained in the MATES III report.

**Table D-2: Comparison of monitored (using DPM/EC ratio approach) and modeled changes in basin-wide risk (per million) between MATES II (1997/1998) and MATES III (2004-2006)**

| Method | MATES II | MATES III | % Change |
|---|---|---|---|
| Monitored (DPM/EC ratio) | 1,400 | 839 | -40% |
| Modeled | 981 | 812 | -17% |

The SCAQMD notes that MM5-derived vertical mixing used in MATES III produces increased vertical mixing in CAMx compared with what was used in the UAM-Tox model in MATES II. This suggests that a methodology change in the modeling may be biasing the MATES III modeled risks lower compared to MATES II (page 4-3). However, this change is in the wrong direction in terms of explaining the discrepancies between the monitored and modeled change in risk between MATES II and MATES III. Furthermore, the rate of vertical mixing in the MATES III modeling is exacerbated by the choice of vertical layers selected by the SCAQMD for the modeling. According to the MATES III documentation, the SCAQMD elected to configure CAMx with only 7 vertical layers, which is insufficient to adequately resolve the rise of the mixing height during the day and will overstate the rate of vertical mixing. When the MATES III modeling inputs were received we noted in fact that 8 vertical layers were used, not 7 as stated in the documentation, which are still too few to resolve the rate of vertical mixing. Note that other studies are using many more layers, for example the Western Regional Air Partnership (WRAP) is using 19 vertical layers in their CMAQ and CAMx modeling.

The SCAQMD attributes the 17% reduction in risk between MATES II and MATES II modeling to several factors: updated emission estimates and spatial allocation, meteorological model selection and different weather conditions for the two modeling periods. The draft Report did not mention as a possible explanation reductions in air toxic emissions due to implementation of the air toxics and ozone/PM control plans. In Table IX-2 of Appendix IX the SCAQMD presents a MATES II (1998) DPM emissions inventory using the MATES III emissions modeling methodology that is 26% higher than the DPM inventory used in MATES II. Assuming an across-the-board scaling of DPM risk to DPM emissions, updating the MATES II modeled risk using the MATES III emissions methodology would increase the MATES II modeled risk to approximately 1,160 in a million so that the modeled risk improvement between MATES II to MATES III would be a -30% reduction, which is closer to the -40% risk improvement between the two studies estimated from monitoring data. Thus, both the monitored and modeled risks between MATES II and MATES III are showing substantial reductions in risk.

*Port-specific modeling issues*

One major discrepancy between the MATES III monitored and modeled risk is how particulate matter (PM) emissions from marine vessels are treated. The diesel source profile used in the CMB modeling was based on on-road diesel vehicles, and did not characterize PM emissions from marine vessels. The monitored $PM_{2.5}$ concentrations associated with marine vessels are captured in the CMB Residual Oil Burning (ROB) source category, not the DPM source category. In the modeling analysis, ship emissions are characterized as DPM emissions. The effect of these two different approaches should be discussed in the Report. (ENVIRON also notes that the modeling results for ship emissions (Figures IX-10c and IX-12d) indicate that ship emissions do not penetrate very far inland. This information should be considered when analyzing the results of the CMB analysis for stations near and far from the Ports).

The MATES III reports notes that the highest modeled risk occurs in the grid cells in the areas near the Ports with modeled values of 1,100 to 2,900 in a million, and that these are substantially higher than any other area. However, the monitored risk calculations do not support this conclusion. In fact, the Wilmington MATES III monitoring site closest to the ports, which is within the modeled elevated risk plume from the Port area according to the modeling (see Figures ES-1 and ES-4 from MATES III), is not even the monitor with the highest risk (see Table C-9 of Attachment C). Of the 10 MATES III fixed site monitors, Wilmington is in fact in the middle of the range, with monitoring results below those of Fontana, Burbank, Huntington Park and Central LA. The modeled and monitored risk calculations should be presented together and should provide a consistent story.

The difference in the modeled and monitored risk in the Port area is also evidence in the performance evaluation of the MATES III model. Using the model evaluation for $EC_{2.5}$ as a surrogate for DPM performance, we see that the MATES III modeling is biased high in the western Basin near the Ports and biased low further inland. For example, as seen in Table IX-5 in Appendix IX, the MATES III model over-predicts the $EC_{2.5}$ at Wilmington and North Long Beach by +25% and +55% at the two sites closest to the Ports, but under-predicts $EC_{2.5}$ by -27% and -40% at the Fontana and Rubidoux monitors in the inland empire. Clearly the model is biased toward over-predicting $EC_{2.5}$, and consequently DPM, in the Port area, which is an important caveat to be included in the MATES III report. The MATES III report also asserts that the highest toxics risk of 2,879 in a million was located at the Port of Los Angeles/Long Beach. Figure D-1 below was presented at the MATES III March 13, 2008 TAG meeting and shows the location of the maximum modeled risk (2,879 in a million) as being on the property of the Port of Long Beach and partially into San Pedro Bay. As the DPM unit risk factor is based on 70 year residential exposure history, we would recommend that this grid cell, as well as cells over water and industrial portions of the Ports, be excluded when reporting "peak" basin risk.

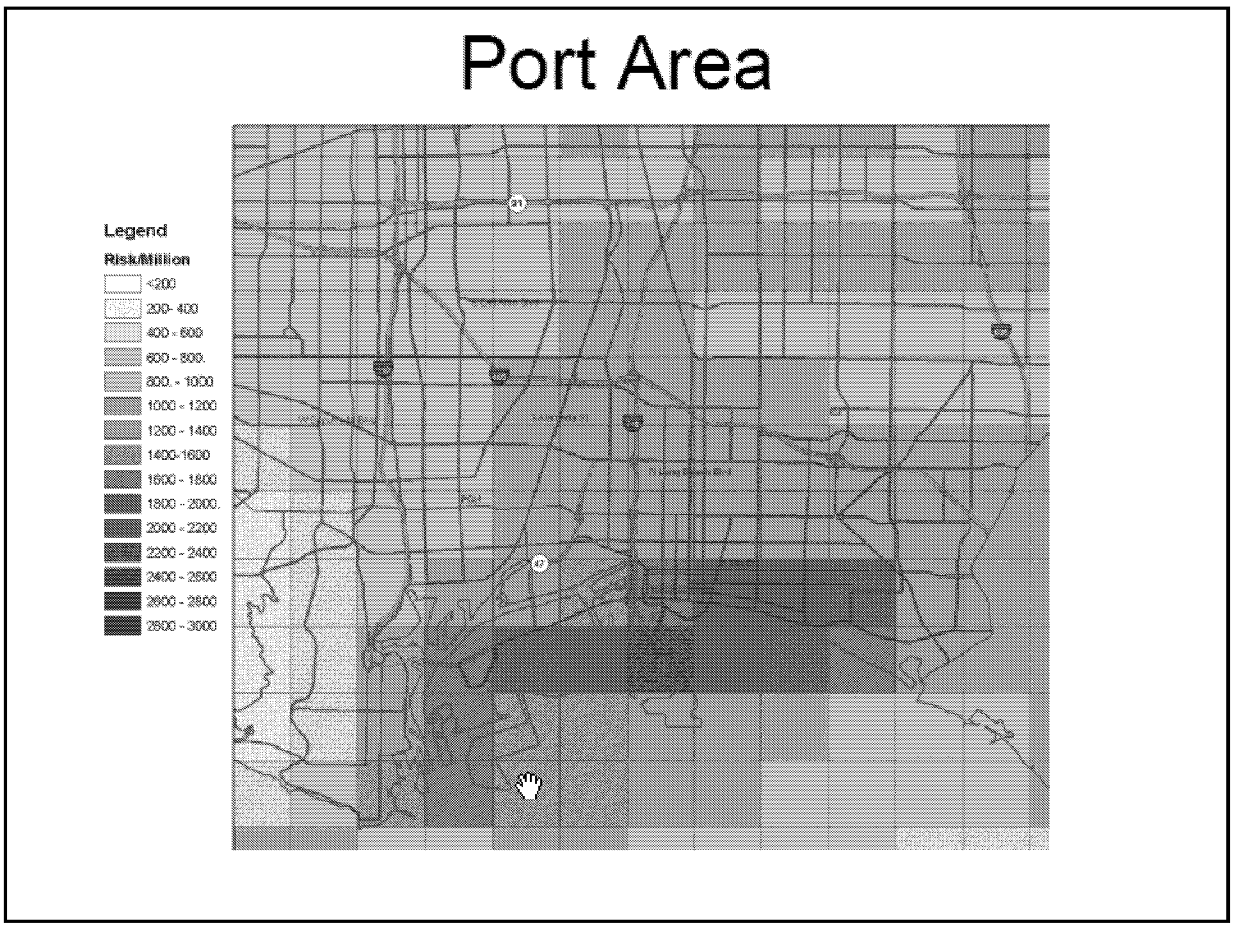



**Figure D-1.** Close up of MATES III modeled risk in the Ports area.

*Conclusions*

In summary, the initial review of the MATES III modeling based on available documentation has identified numerous areas of inconsistencies between the modeled and monitored risk that need further investigation. Further study of the MATES III modeling databases is also needed to fully understand what was done so that meaningful comments on the analysis can be made for the District's consideration. As noted previously, the District has provided ENVIRON with the ~100,000 Mb of MATES III modeling inputs on March 26$^{th}$ and 28$^{th}$ so there was insufficient time to incorporate any findings from the modeling databases into this review. Per communication from the District, ENVIRON will continue to work with District staff to present findings from review of the modeling databases (and output files, when received) after the commenting deadline.

# Attachment E:
# Initial Review of the MATES III Emissions Inventory

Verification that the AQMP inventory was actually used is not immediately possible. The emissions reported in the MATES III report are only for individual toxics; the emissions reported in Appendix III of the AQMP report only criteria pollutants. The only overlapping species is diesel PM, assuming this is equivalent to $PM_{10}$ emissions from diesel sources in the 2007 AQMP. However, the AQMP does not report those emissions for 2005 (Attachment F reports diesel PM emissions only for 2002, 2010 and later). Our initial comments are:

- An important ratio used to evaluate modeled vs monitored results is the ratio of DPM to EC in the emissions inventory (see Table ES-2). That reported ratio is 1.72 for DPM to EC in $PM_{2.5}$. However, the emissions inventory data presented in Table 3.4 indicate a ratio of DPM to EC of 1.45 for all sources. It is possible this latter number is based on the ratio of DPM emissions to total EC (not EC in the fine PM fraction), however the value of 1.45 is closer to the value reported of 1.39 on page Appendix V-1 for the 1998 inventory. A change in the inventory ratio of DPM to EC of 1.39 to 1.72, if this is the case, is something that warrants much more explanation in the text. Using a ratio of approximately 1.4 instead of 1.72 and applying this to monitored EC concentrations would result in lower estimated DPM concentrations in Tables ES-2 and Table 2-5, suggesting that the CMB method is over-predicting DPM.
- ENVIRON has identified some inconsistencies in reported DPM emissions and will clarify these with the SCAQMD:
  - Page 2-9 main report: Diesel $PM_{2.5}$ = 26.06 tons/year (this is likely a typo and should be tons/day)
  - Page 3-7 main report, Table 3-4: Diesel particulate = 60390 lbs/day = 30.20 tons/day. ENVIRON assumes the difference with the 26.06 number above is because this estimate refers to all diesel particles and not just diesel $PM_{2.5}$; ENVIRON will attempt to confirm this.
- The modeling chapter in the main report (page 4-1) states that "An updated version of the 2007 AQMP emissions inventory for model year 2005 [was used]". This statement is repeated in Appendix 9 (page IX-10), however later reference is made to the AQMP technical appendices for more detail. ENVIRON assumes the word 'updated' refers to the inclusion of individual toxics using speciation profiles, but that the emissions totals of criteria pollutants are the same between MATES and the 2007 AQMP. ENVIRON will investigate this inconsistency further when requesting data from the SCAQMD: if the inventory has changed ENVIRON will request that the SCAQMD include an explanation for any changes and also provide the total criteria pollutant emissions by minor source category for comparison to the 2007 AQMP.
- ENVIRON requested a more detailed breakdown of the diesel particulate inventory compared to what is given in Appendix VII, for example a breakdown of emissions by type of ship and for heavy-duty vehicles.

- The MATES III inventory is speciated into model species but also into individual toxic compounds for tracking in the model; this speciation is done using ARB's speciation profile database. Known uncertainties in ARB speciation profiles should be discussed in MATES III. It is not clear whether source profiles used for CMB modeling are the same source profiles in ARB's database for sources such as gasoline vehicles. To the extent that this influences the evaluation of modeled versus monitored risk, these differences should be discussed in detail.
- The main report (page 3-2) states that top-down speciation using ARB profiles was done so that the same programs "used to grow and control the VOC and PM emissions into the future for the 2007 AQMP can also be used for projecting the toxic emissions in MATES III. Thus, the future risk reductions resulting from the 2007 AQMP can be estimated." This future projection of risk due to controls is not part of this MATES III analysis, but would likely be a part of the planned SCAQMD revision of its Air Toxics Control Plan (ATCP).
- The main report (page 3-4) states that major speciation profiles for on-road hydrocarbons and PM are in Appendix VII; however these profiles were not found in ENVIRON's review of the MATES III report.

### Status of data requests

- ENVIRON is still requesting:
  - a detailed toxics and criteria pollutant emissions inventory database (in electronic format) by minor source category.
  - the emissions of particulate toxic components in the $PM_{10}$ and $PM_{2.5}$ size fractions, compared to the total particulate component emissions presented in Table 3-4 and Appendix VIII of the draft MATES report.
  - An emission inventory summary by minor source category, particularly for off-road mobile sources such as ships, trains and off-road equipment. (Appendix VIII provides a summary by major source category only.)
  - Speciation profiles used to determine toxic components of VOC and PM emissions.
- ENVIRON will continue to work with District staff to understand differences, if any, in emissions assumptions, activity, or factors between MATES III and the 2007 AQMP.

# Attachment F: February 25, 2008
# Request for MATES III Data and Related Information

February 25, 2008

Jean Ospital, Ph.D.
Health Effects Officer
South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, California 91765

Re: Request for MATES III Data and Related Information

Dear Dr. Ospital:

ENVIRON International Corporation (ENVIRON) recognizes the efforts that the South Coast Air Quality Management District (SCAQMD) has devoted to understanding air toxics in the South Coast Air Basin (Basin), including its latest Multiple Air Toxics Exposure Study (MATES) known as MATES III. We believe that the data and results of this analysis will be important and valuable to the air quality and health sciences communities, as well as local stakeholders and the general public. Based on previous discussions with SCAQMD staff, ENVIRON understands that the MATES III technical data will be available to the public, stakeholders, and outside reviewers. These data are crucial for conducting meaningful peer review and commenting. ENVIRON thus requests the data and other information described in Attachment A. Given the 90-day window for public comments, we kindly request that the data and other information be made available as expeditiously as possible. If some of the data are not in a form ready to transmit immediately, please send any requested data / information that are available and let us know the timing for information that is not currently ready to transmit. A conference call may be the most efficient way to transmit some of the requested information on methodologies or datasets. We are willing to work with SCAQMD staff to help meet our request in a manner convenient to them, including meeting with staff directly at the District's headquarters in Diamond Bar.

Please feel free to contact us if you have any questions about this data request or suggestions on the best method of transmitting the data.

Very truly yours,

Robert Scofield, D.Env
Principal, Emeryville California
Phone: 510-420-2551
Email: rscofield@environcorp.com

Ralph Morris
Managing Principal, Novato California
Phone: 415-899-0708
Email: rmorris@environcorp.com

MR:slb
P:\P\POLB Air Quality Services 3\MATESIII\Data Request Letter to SCAQMD\SCAQMD MATES III Data request Final 2-19-2008.doc

Enclosure

## ATTACHMENT A: REQUESTED DATA AND OTHER INFORMATION

The following is a list of requested MATES III data or other related information. ENVIRON has attempted to make this list as comprehensive as possible, but based on the review of this data, ENVIRON may seek additional information at a later time.

### A. Report Results Data

- Grid cell data files for modeled data reported in the Main Volume of the MATES III report. Examples would include Figures ES-4 and 4-2(a-d). If the regional modeling output files can be provided immediately, they would suffice.

### B. Monitoring Data

- Air monitoring data (i.e., each individual measured concentration, of each pollutant referenced in Table 2-1 of the MATES III report, by station, by date) in electronic form.
- Meteorological data collected at the sites, in electronic form.
- Addresses/locations of the micro-scale sites.

### C. Regional Modeling Databases

- CAMx regional modeling input and output files, including model-ready emissions and meteorological files.
- Pre-merged emissions files by source categories, as available.
- Emissions modeling input data, emissions modeling source codes (if different than those used in the 2007 Air Quality Management Plan) and ancillary data sufficient to reproduce the regional emissions input into the MATES III modeling.

### D. Contribution of Diesel and Other Sources to Ambient Samples

- Analytical results from $PM_{2.5}$ Particulate Bound Organic Compound Analysis in electronic form.
- Chemical Mass Balance (CMB) inputs/outputs and other information that will allow independent reproduction of the analysis including:
  - Dataset of ambient data collected and used in the CMB analysis.
  - Detection limits for the various species used in the MATES III analysis.
  - Short explanation of how missing values and values below detection limit were treated in preparing CMB inputs.
  - CMB input files (for all sites):
    - Ambient data set(s).
    - Source-profiles used in the analysis.
    - List of fitting species used in the analysis (species "select" file).
    - List of source-profiles used in the analysis (profile "select" file).
  - We would like to discuss with SCAQMD staff the role of uncertainties in species concentrations and source-compositions.
  - The raw results from the CMB analysis.

**E. Emissions Inventories**

- Unless supplied in response to the regional modeling data request in Section C above, a detailed toxics and criteria pollutant emissions inventory database (in electronic format) by minor source category. ENVIRON also requests the emissions of particulate toxic components in the $PM_{10}$ and $PM_{2.5}$ size fractions, compared to the total particulate component emissions presented in Table 3-4 and Appendix VIII of the draft MATES report.
- An emission inventory summary by minor source category, particularly for off-road mobile sources such as ships, trains and off-road equipment. (Appendix VIII provides a summary by major source category only.)
- Speciation profiles used to determine toxic components of VOC and PM emissions.
- A description of any differences in emissions assumptions, activity, or factors between MATES III and the 2007 AQMP. This could be done through a telephone conference call, if that is more convenient.

March 3, 2008

Dr. Jean Ospital, Health Effects Officer
South Coast Air Quality Management District
21865 Copley Dr,
Diamond Bar, CA 91765

Re: Request for 30-day Extension in the MATES III Comment Period

Dear Dr. Ospital:

The San Pedro Bay Ports appreciate the efforts of the South Coast Air Quality Management District (the District) in completing the draft MATES III report and the attendant analyses. MATES III is comprehensive in scope, and provides substantial and important scientific data on air toxics in the South Coast Air Basin.

As you know, ENVIRON International Corporation is reviewing the recently released MATES III report on behalf of the ports of Long Beach and Los Angeles, and will likely assist us in preparing written comments on the report and its underlying evaluations. They have completed an initial review of the report, and on the basis of that review have requested additional information from the District. We greatly appreciate your willingness to both provide the information and to meet with them to discuss the underlying data and modeling.

Because of their familiarity with the models (e.g., CAMx) used in the MATES III evaluations and their familiarity with the MATES II efforts, ENVIRON is in a position to complete a review of the evaluation as quickly as anyone. Nonetheless, the amount of data and the complexity of the modeling are substantial, as you are well aware. Now that we have seen the report and its several appendices, we have a better appreciation for the level of effort and time required to review and to develop an understanding of the complex analyses underlying the report. It is our understanding that you sent the monitoring data on Friday, February 29, but that the requested modeling data and related information may not be available for a couple of weeks, due to its size, multiple components, and complexity. After receiving the data, our consultants will need sufficient time to review the data, exercise the models (as needed), and complete their review of the methodology and results. Then, we will need time to discuss their technical assessment and prepare our comments. Even if the data are received before the March 13, Technical Advisory Group (TAG) meeting, it would not be feasible for us to comment meaningfully by April 4, the current draft MATES III Report commenting deadline.

Accordingly, we request the District grant a 30-day extension in the comment period to May 5, 2008, assuming that the modeling data can be delivered before or around the March 13 TAG meeting. (If the modeling data are delayed, we may ask for additional time.) We recognize than the District is under a great deal of pressure to finalize the report, but we believe that everyone will be better served by allowing adequate time for peer review. The additional time is needed for a better understanding of the underlying analyses and will allow the development of better considered comments and constructive suggestions.

Please feel free to contact either Paul Johansen, Port of Los Angeles, at (310) 732-3678 or Richard Cameron, Port of Long Beach, at (562) 590-4156 if you have questions or concerns regarding this request.

Sincerely,

Richard Cameron
Director of Environmental Planning
Port of Long Beach

Ralph Appy
Director of Environmental Management
Port of Los Angeles

cc: Dr. Barry Wallerstein, Executive Officer
Dr. Rob Scofield and Mr. Ralph Morris, ENVIRON International Corporation